

Endangered Species UPDATE

*Including a Reprint of the latest USFWS
Endangered Species Technical Bulletin*

June/July 1988 Vol. 5 No. 8 & 9

THE UNIVERSITY OF MICHIGAN
School of Natural Resources



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Avoiding the Triage Question

by Bryan G. Norton

The triage formulation is intimately linked with the species-by-species approach to preservation, and the species-by-species approach is a natural outgrowth of the world view on which nature is seen as a warehouse of raw materials to be protected because they may prove useful in the technological production of commodities or for aesthetic "consumption."

The magnitude of the problem of disappearing species viewed worldwide, dwarfs resources currently available to address it. By the end of the century, experts predict, as much as one species will be lost every hour. Faced with shrinking budgets and accelerating extinction rates, environmental managers agonize over which species to save. Different criteria for placing value on species - ecological, economic, aesthetic, cultural - compete with one another, and controversy abounds. One proposal for sidestepping direct debates about the value of species is to adopt a system of triage, which takes its name from the French policy of sorting wartime casualties into three categories for medical treatment: those with superficial wounds that do not require immediate attention; those with wounds too serious to make treatment efficacious; and those in the middle range, having serious but treatable wounds.

Once the issue is formulated in this manner, it seems obvious that efforts toward species preservation are best concentrated in the third category. Scarce funds and energies should be targeted at saving those species that are both in need of saving and susceptible to being saved. But the most arresting formulation of an issue is not always the most illuminating one; it will be useful to stand back from the triage formulation, which casts the problem of setting priorities as one of sorting species into

categories, and ask whether there are other, more fruitful ways to look at the problem.

What Is the Endangered Species Problem?

The endangered species problem is not a single problem. It is more accurately seen as four closely related problems: (1) what should be done when a species' population becomes so depleted as to threaten its continued existence; (2) what should be done to keep relatively healthy populations from declining and thereby falling into the threatened category; (3) how to avert, or at least slow, the predicted and potentially cataclysmic reduction of biological diversity over the next few decades; and (4) how to slow the trend toward conversion of natural systems to intense human use?

In the triage formulation the priorities problem is most naturally associated with question (1) because it considers threats to individual species. Once threatened, species require management initiatives designed to protect and nurture them, individually. But the goal of protecting biological diversity should not be reduced to the goal of protecting remnant populations of threatened species. If one thinks about the endangered species problem in this way, there is a tendency to treat it as merely a problem of protecting genetic

diversity, with each species regarded as a repository for a set of genes. Indeed, some preservationists speak as if the protection of species involved little more than preserving samples of seeds and germ plasm.

Biological diversity is a much broader concept than genetic diversity. Biological diversity is constituted not merely by the number of species, subspecies, and populations extant, but also by the varied associations in which they exist. A species existing in an ecosystem represents not a static but a changing pool of adaptations, a whole series of different genetic dynamics and varied evolutionary trajectories. Diversity of biological life is also a valuable aesthetic and cultural resource. To perceive biological diversity only in terms of a diverse gene pool is to ignore the whole range of aesthetic and cultural values dependent upon varied landscapes.

Loss of genetic diversity is a manifestation of the deeper problem of decreasing biological diversity. As natural habitats are altered, converted, and simplified, many species suffer a decline in their number of independent populations. Attempting to protect genetic diversity through the protection of a few remnant populations will result only in a continual scramble to save individual species. A broader approach, by recognizing the forces that bring species to a threatened stage,

should keep more species from requiring individual attention. The triage formulation of the priorities issue would, in the process, be circumvented. Society would no longer face an interminable series of difficult choices among threatened species. Rather, the problem would be viewed holistically as one of halting the tendency toward habitat destruction and loss of biological diversity.

Nature as Habitat vs. Nature as Warehouse

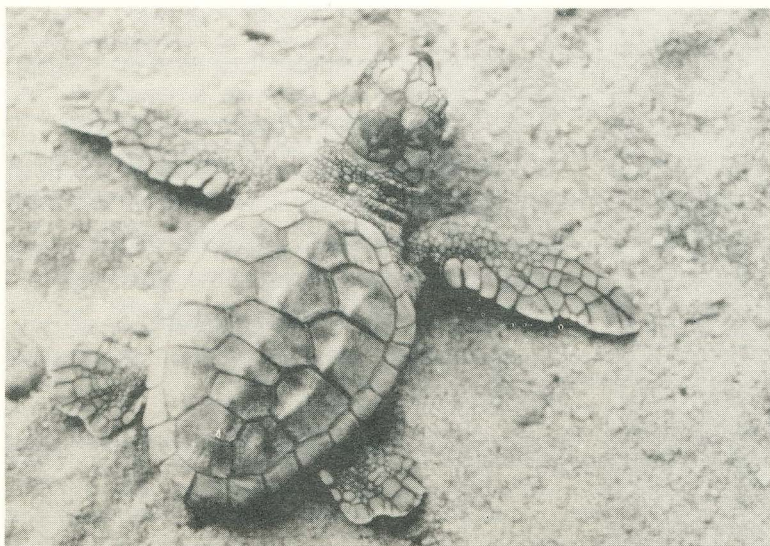
Viewed in its most general terms, the problem of endangered species raises questions about the sort of relationship modern technological societies can and should have with nature. Will we see ecosystems as human habitats, as associations on which human life depends? If so, we will see them as having a holistic integrity that must be protected. Or will we see natural objects as no more than commodities available for use in the production of goods and services? Nature is then seen as a warehouse of consumable supplies.

In the warehouse view, nature is seen as a self-replenishing supply of goods and services; humans assume they can go to it and find what they need when they need it, drawing on its resources without fear of depletion. If the population of some species falls below a danger point, thereby threatening access to it as a commodity, then that

species is "listed" for special concern; it is isolated from normal interaction with humans, saved for future consumption. It is never asked why human beings cannot normally cohabit with other species or why more and more species suffer precipitous declines in population.

The warehouse view is widely held these days. Nature is no longer seen as the human habitat. It is no longer seen as a producer, sustainer, giver of life. Nature can produce, but humanly manipulated monocultures do it more efficiently. Nature can provide an endless variety of genetic resources, but these can be better protected in gene banks. Nature can provide aesthetic experiences, but it's easier to get them in zoos. Humans are not seen as one species, like others, inescapably dependent on natural systems. Technology increasingly insulates humans from the ways in which they depend on nature. Nature becomes not a place to live, but a repository of raw materials to be extracted and used in technological forms of production.

It is not necessary to undertake a metaphysical critique of the nature-as-warehouse approach. The triage formulation of the priorities problem is, in a practical sense, a test case for that approach. The triage formulation is intimately linked with the species-by-species approach to preservation, and the species-by-species approach is a natural outgrowth of the world view on which



loggerhead sea turtle hatchling

photo by Donna Dewhurst, USFWS

Endangered Species UPDATE

*A forum for information exchange on
endangered species issues*

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The Endangered Species UPDATE welcomes articles related to species protection in a wide range of areas including but not limited to: research and management activities for endangered species, theoretical approaches to species conservation, and habitat protection and preserve design. Book reviews, editorial comments, and announcements of current events and publications are also welcome.

Readers include a broad range of professionals in both scientific and policy fields. Articles should be written in an easily understandable style for a knowledgeable audience. Manuscripts should be 7-10 double spaced typed pages. For further information please contact Kathryn Kohm at the number listed below.

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Alabama cranebrake pitcher plant
(*sarracenia rubra* var. *alabamensis*)

photo by Randy Troup

nature is seen as a warehouse of raw materials to be protected because they may prove useful in the technological production of commodities or for aesthetic "consumption." But the triage formulation fails. More and more species are threatened by habitat destruction caused by technological advances and by expanding human populations; smaller and smaller proportions of species that require protection will receive it. The triage formulation leads to insoluble problems. Resources are not available to protect, on an individual basis, all the species that will be threatened by a policy permitting wholesale conversion and alteration of natural systems. Worse, in many species-rich and highly threatened areas including much of the tropics, conservation biologists lack even rudimentary lists of species existing there and have almost no knowledge of the life requirements of the individual species. The world view that sees nature as a warehouse of commodities is not, in the long run, conducive to the goal of species preservation, especially in cases such as these—one cannot protect, individually, the contents of a warehouse if one lacks even an inventory of those contents.

Habitat Protection

Instead of asking, "Which species should be saved?" we should ask in-

stead, "How might agencies best spend the resources available to protect biological diversity?" Habitat or ecosystem protection provides a more promising approach to preserving species than activities designed to protect species individually.

The advantages of a holistic, ecosystem approach are numerous. Protection of large areas from human alteration serves as a reminder that human life grew out of and is sustained by the productive forces of nature. It treats species not as commodities held in waiting, ready at hand to provide goods and services as the need arises, but as having an independent existence of their own, drawing upon resources available in the natural communities to which they also contribute. Habitat protection provides opportunities to encounter species not only in zoos and botanical gardens, but also in natural settings, leaving room for unexpected encounters with other species that can jar the senses and the sensibilities.

Above all, the habitat protection approach has a reasonable chance of success. Funds and efforts expended to protect species by protecting ecosystems and habitats are far more likely to be successful in the long run. In isolation from their habitat, species require great amounts of care. Managers often lack the knowledge and resources necessary to provide substitutes

for the services provided naturally in undisturbed ecosystems. The ecosystem approach protects species before they reach critical stages and require individual attention. Addressing the problem in less acute stages leads to more efficiency per dollar spent. Efforts of this sort address not just the problem of how to save species once they have become severely endangered. They address all four forms of the endangered species problem simultaneously, by keeping healthy populations from undergoing decline, by protecting biological diversity generally, and by placing limits on how natural systems are altered for human use.

It would appear, then, that when the question of priorities is posed as one of how best to expend funds and efforts, the answer is clear. They should be expended to protect as many and as varied types of natural systems as possible.

A Comprehensive Effort Outlined

A national effort is necessary to attack all four of the endangered species problems listed above in a coordinated manner. The central offensive in such a campaign should be the protection of habitat. Domestically, this would require development of a set of categories identifying types of habitats and



black footed ferret

photo by Tim Clark

The world view that sees nature as a warehouse of commodities is not, in the long run, conducive to the goal of species preservation . . . one cannot protect, individually, the contents of a warehouse if one lacks even an inventory of those contents.

(Continued on UPDATE page 4)

ENDANGERED SPECIES

Technical Bulletin

Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 20204

California Sea Otter Translocation: A Status Report

Robert L. Brownell, Jr., and
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As late as the 19th century, sea otters (*Enhydra lutris*) were found from northern Baja California to Alaska. By the early 20th century, however, they had been extirpated from Baja California and most of California by fur hunters. Because of isolation and protection, a small population in the Big Sur area of central California survived and slowly expanded its range to about 200 miles of coastline along the center of the State. Because this small, restricted population is vulnerable to a single catastrophic event, such as an oil spill from a tanker accident, the U.S. Fish and Wildlife Service listed the California sea otter on January 14, 1977, as Threatened.

On August 11, 1987, the Service published a final rule to establish an experimental population of California sea otters at San Nicolas Island, one of southern California's Channel Islands, about 70 miles west of Los Angeles. The purposes of this reintroduction were to: 1) implement a primary recovery action for this animal; 2) obtain background information for assessing sea otter reintroduction and containment techniques; 3) gather data on population dynamics and ecological relationships of sea otters with their near-shore community; and 4) evaluate effects on the donor population of removing otters for the reintroduction. Related to the reintroduction project was the designation of a "no otter" management zone in southern California south of Point Conception and including all the Channel Islands except San Nicolas. (See BULLETIN Vol. XI Nos. 8-9 and 10-11 for details leading up to the reintroduction.)

Personnel from the Service and the California Department of Fish and Game worked during periods of good weather between late August 1987 and the end of March 1988 to capture the sea otters. Three techniques were used: dip netting, underwater traps operated by SCUBA divers; and floating tangle nets. By March 1988, 113 otters had been caught along the central California coast. Nearly half of these were immediately released at their



California sea otter

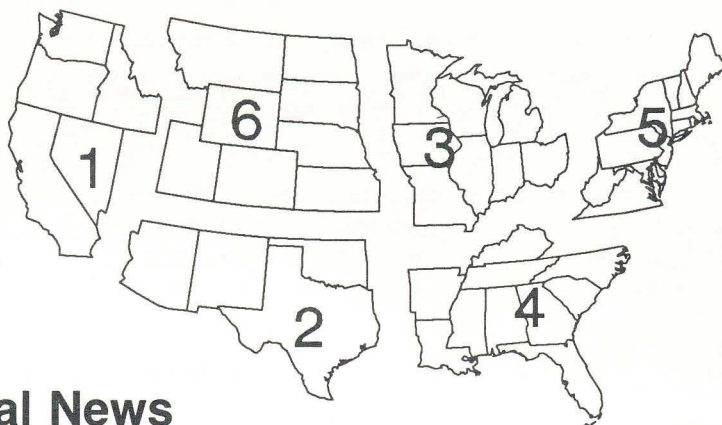
capture site because of sex and size limitations. Sixty-eight of the otters were transported by truck to the Monterey Bay Aquarium, tagged on the rear flippers, screened for health abnormalities, and prepared for shipment to San Nicolas Island. Four died while at the Aquarium, and a fifth animal was returned to its original capture site and released. The remaining 63 sea otters (14 males and 49 females) were flown to San Nicolas Island in eight groups of one to 24 animals.

Censusing the otters at the island has been difficult because of poor weather and sea conditions, access limitations, and the difficulty of seeing the color-coded flipper tags. Censuses have not only been hampered by winter storms,

including one of the worst on record for southern California, but also by closures of the island during weapons tests. (The island is part of the U.S. Navy's Pacific Missile Test Center at Pt. Mugu.) When surveys are possible, each animal is observed until the unique color combination and position of the flipper tags is determined. This can take up to 2 hours if sea conditions are poor or if the animal is further than about a half mile from shore. Some otters have gone unidentified for extended periods of time. For example, one animal observed in October was not seen again until January, despite intensive efforts to individually identify otters at the island.

(continued on page 6)

photo by Richard Bucich, courtesy Friends of the Sea Otter



Regional News

Regional endangered species biologists have reported the following news and activities for March:

Region 1 — Fourteen woodland caribou (*Rangifer tarandus caribou*) were

released in the panhandle of Idaho. The animals were captured from a herd near Williams Lake in British Columbia, Canada. A total of 24 animals have been moved from Canada this year to join 24

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animals translocated to Idaho in 1987 to supplement the Endangered southern Selkirk Mountain herd of woodland caribou. The State of Idaho considers this year's translocation to be a success. Most animals have stayed in the vicinity of the release site. One caribou died during the capture effort this year for a total of only three known mortalities in 2 years. A final translocation of animals is planned for 1989.

* * *

At the request of the Hawaii State Board of Land and Natural Resources, the Fish and Wildlife Service's Honolulu Field Office prepared a detailed list of high quality streams in Hawaii that deserve special protection from flow and channel alteration. Selection criteria included habitat for Endangered waterbirds and migratory waterfowl, riparian wetlands, anadromous fish habitat, National and State parks, wilderness areas and natural area reserves, and streams listed on the Nationwide Rivers inventory.

* * *

Biologists recently discovered a new population of the California jewelflower (*Caulanthus californicus*) on the southern Carrizo Plain, California. This plant is a Category 2 candidate for a future listing proposal. The discovery doubles the number of known natural populations of this species. One introduced stand of the California jewelflower occurs on The Nature Conservancy's Paine Wildflower Memorial Preserve.

* * *

Staff from the Service's Laguna Niguel, California, Field Station accompanied U.S. Navy and California Fish and Game personnel to San Clemente Island for a San Clemente sage sparrow (*Amphispiza belli clementeae*) survey. Results of the survey indicate that the population of this Threatened bird appears to be stable.

* * *

Region 2 — In early March, two ocelots (*Felis pardalis*), a male and a female, were translocated within the Laguna Atascosa National Wildlife Refuge on the southern coast of Texas. The female has remained in the relocation area but the male has moved about 5 miles north of the release site (still on the refuge). These Endangered cats were moved from areas where their risk of being hit by motor vehicles was high to an area of suitable habitat on the refuge that was unoccupied by ocelots. Five ocelots have been killed by motor vehicles on or near the refuge in recent years.

* * *

As part of a 1988 joint special project with the Oklahoma Department of Wildlife Conservation, the Service's Tulsa Field Office will implement recovery measures for the interior population of the least tern (*Sterna antillarum*). This population of the

(continued on page 7)

Approved Recovery Plans

Carla W. Corin
Division of Endangered Species and
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Washington, D.C.

Tobusch Fishhook Cactus

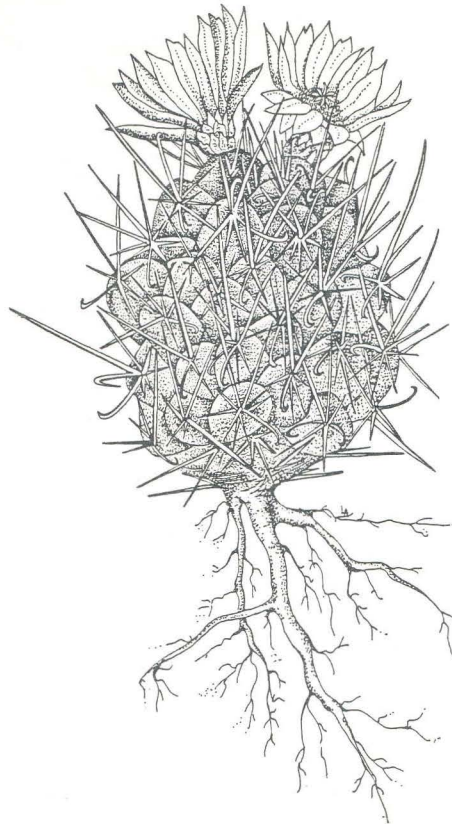
The Tobusch fishhook cactus (*Ancistrocactus tobuschii*), listed as Endangered, was first described in 1952 from a specimen collected a year earlier on the G. W. Henri Ranch east of Vanderpool, Texas. At the time of listing (1979), fewer than 200 plants were known.

This cactus grows as solitary stems up to 3.5 inches (9 centimeters) in diameter and nearly as tall. It is named for its discoverer, Herman Tobusch, and for the reddish-tipped fishhooked spine that extends laterally from the three to five central spines arrayed on each areole, which is surrounded by seven to nine radial spines. Yellow flowers 1.2 to 1.5 inches (3.0 to 3.8 cm) in diameter, each lasting nearly a week, appear from mid-February to mid-March. Most flowering is over by early April, and the green fruits ripen during the last half of May.

Historically, the Tobusch fishhook cactus has been recorded in the Edwards Plateau area of south-central Texas in Kerr, Bandera, Real, Kimble, and Uvalde Counties. Surveys in 1985 found a total of six populations in all but Kerr County. The Henri Ranch population originally discovered in 1951 has been extirpated, probably during land clearing in the 1960's. Most of the sites are on private land, but one is on a State highway right-of-way and another is on State land administered by Texas Tech University.

The Tobusch fishhook cactus grows in gravelly soils on streambanks where dominant vegetation is juniper, oak, and sycamore. In this habitat, the plants are subject to flooding, which may destroy the plants and their habitat. Many specific details of the habitat requirements of this cactus are unknown. Threats to its survival include real estate development, trampling by livestock, flooding and erosion of its habitat, and collection by cactus fanciers. Cacti are generally prized by collectors, and when the rarity of a species is known, it becomes even more of an attraction. Many of the locales inhabited by this species are well known to collectors through earlier literature.

The prime objective of the Tobusch Fishhook Cactus Recovery Plan (approved by the Fish and Wildlife Service on March 18, 1987) is to establish 4 safe populations of 3,000 plants each. At this level, which is expected to take at least 5 years, there would be sufficient genetic diversity and a buffer against catastrophic reduction or loss of one or more of the populations, and the Tobusch fishhook cactus could be considered for reclassification from Endangered to Threatened.



Tobusch fishhook cactus (*Ancistrocactus tobuschii*)

When reclassification is accomplished, the plan will be reevaluated and criteria for attaining full recovery can be determined. Specific steps in the recovery plan are to:

1. remove immediate human threats by protecting known populations from collecting and habitat destruction;
2. establish a permanent living collection at a botanical garden or university;
3. minimize long-range threats by development of biological information relevant to recovery;
4. establish a 5-year survey program to more precisely determine the distribution of the species;
5. develop a comprehensive trade management plan for all cacti;
6. develop a program to provide propagated plants and seeds to commercial markets; and
7. develop public awareness, appreciation, and support for the preservation of this species.

These recovery steps will require the cooperation of the private landowners and government land managing agencies on whose land the cactus is found. Working together, all parties can help save this unique plant.

Three Florida Mints

The Recovery Plan for Three Florida Mints was approved by the Fish and Wildlife Service on July 1, 1987. These Endangered plants, all inhabitants of sandy scrub communities, are threatened by ever-expanding development in peninsular Florida.

These congeneric mints are perennials with a woody base and non-woody flowering shoots. They are aromatic, with a strong minty odor, and all three inhabit bare sand exposed to sunlight. Lakela's mint (*Dicerandra immaculata*) grows to 1.3 feet (40 cm) in height and has lavender-rose to purplish flowers which bloom from September to November. It is endemic to a narrow strip of the Atlantic Coastal Ridge between Vero Beach and Fort Pierce. All known sites are on private land, mostly in residential lots, where it grows in well-drained sand at the margins of sand pine scrub.

Scrub mint (*D. frutescens*), with white or pale pink flowers spotted with dark reddish-purple, grows up to 1.6 feet (49 cm) high and blooms in September and October. It inhabits a limited area of the Lake Wales Ridge in Highlands County. One of its four known sites is the Archbold Biological Station, where it has been able to persist indefinitely in fire lanes through the sand pine scrub. Two other localities have recently been sold or partially destroyed. A remaining locality is in a subdivision and is susceptible to development.

The longspurred mint (*D. cornutissima*) also grows to 1.6 feet (49 cm), and its purple-rose flowers also are spotted with reddish-purple. It is found southwest of Ocala on the Sumter Upland in Marion County, and formerly occurred also in Sumter County. This species inhabits the margins of scrub vegetation. Its largest populations are in residential subdivisions, frequently along street rights-of-way, where it tends to be eliminated as homes are built. None of its known populations are in protected areas, although the Cross-Florida National Conservation Area (in the planning stages) will include suitable habitat for the mint.

The major threats to the survival of these species have been loss of habitat due to development (commercial, residential, and sand mining) and depletion of the gene pool because of small population sizes.

According to the recovery plan, any of the three species can be considered for reclassification to Threatened when 10 separate, self-sustaining populations are established at secure sites in peninsular Florida. Delisting can be considered when a species reaches 20 separate, self-sustaining populations. These goals are subject to change depending on any new information discovered during the recovery.

(continued on page 4)

Approved Plans

(continued from page 3)

ery process, including new interpretations of the systematics of this genus.

To attain these recovery goals, it will be necessary to protect and manage existing populations through means such as conservation easements, lease agreements, or acquisition of sites by Federal, State, or local agencies. Protection may require emergency actions where habitat destruction is imminent, possibly including removal of plants from such sites if they can be used elsewhere to aid in the recovery effort. Protected habitats will need to be managed to prevent excessive vegetational succession. Prescribed burning may be the best tool in some instances to prevent encroachment of trees and shrubs into the open sites needed by the three mint species.

Conservation of germ plasm is another important part of the recovery process. Research on seed storage and plant propagation is needed, and collections need to be established. One commercial nursery, Woodlander, Inc., in South Carolina, has successfully propagated all three species from cuttings. Work on propagation by seed is proceeding at other institutions.

Establishment and management of new populations in protected sites with suitable habitat is necessary. Preferred areas are where the plants are native: Sumter Upland for longspurred mint, Lake Wales Ridge for scrub mint, and the Atlantic Coastal Ridge from Vero Beach to Stuart for Lakela's mint.

Nashville Crayfish

The Nashville crayfish (*Orconectes shoupi*), listed in 1986 as Endangered, is found only in the Mill Creek drainage in Davidson and Williamson Counties, Tennessee. There are also records from Richland Creek in Davidson County, but none have been recaptured there and *O. shoupi* may have been displaced at that site by a related species of crayfish.

This 7-inch (18-cm) crustacean has been found in a wide range of environments in Mill Creek, including gravel-cobble runs, pools with up to 4 inches (10 cm) of settled sediment, and under limestone slabs and other cover. Molting individuals and females carrying eggs or young tend to seek out large slabrocks for protection.

The Nashville crayfish has probably never been widespread. The most urgent threat to its survival is water quality degradation. The lower portion of Mill Creek runs through metropolitan Nashville, Tennessee, and the upper reaches are affected by runoff from agricultural areas. Studies have found that water quality has already been affected by pollution from these sources. The presence of a high proportion of its population in an urban

Lakela's mint (*Dicerandra immaculata*)

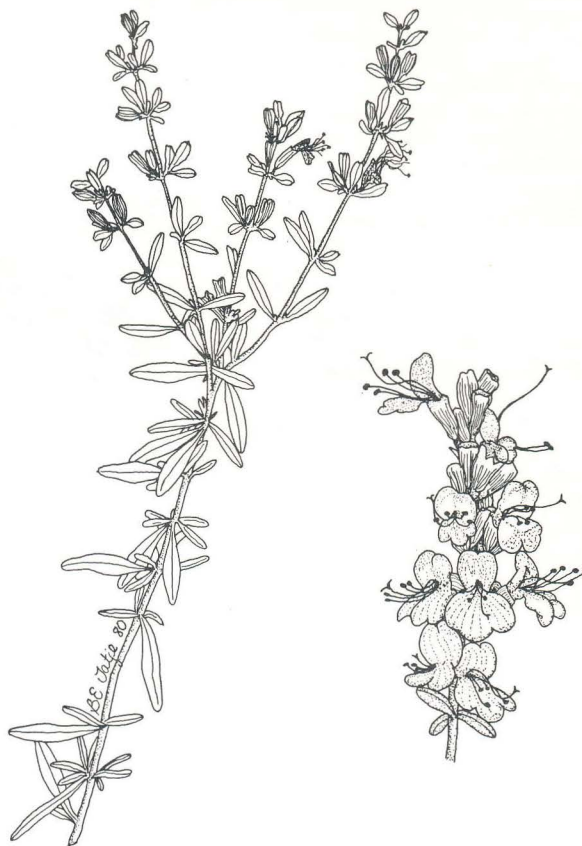
area makes the crayfish vulnerable to a single catastrophic event, such as a chemical spill. Another threat is competition from the related, more abundant, and apparently more adaptable crayfish *Orconectes placidus*, which is suspected to have displaced *O. shoupi* from the Richland Creek drainage.

The Nashville Crayfish Recovery Plan was approved on August 27, 1987. To consider this crayfish for reclassification from Endangered to Threatened status, three goals should be accomplished. First, there should be two viable populations: the existing population and another that is either reintroduced or discovered during further surveys. The second reclassification step is for the reintroduced or discovered population to: a) be self-

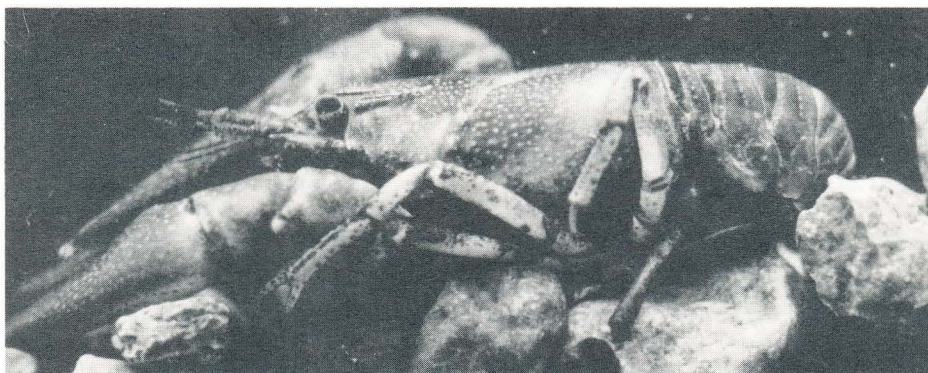
sustaining for at least 10 years without augmentation; b) represent a significant portion of the crayfish fauna of the creek; and c) be stable or increasing in range. (This would help preclude displacement by more competitive species.) The third part of the goal is to sufficiently protect the species and its habitat from both human-related and natural threats likely to cause extinction in the foreseeable future.

Ways to achieve these goals include protecting the existing Mill Creek population through strict enforcement of State and Federal laws regarding Endangered species, water quality, and stream modification. There is also a need to identify current and foreseeable impacts on the Mill Creek habitat and to implement pro-

(continued on page 5)



drawing by Bruce Edward Tatje



Nashville crayfish (*Orconectes shoupi*)

photo by Dick Biggins

Status Reviews Initiated for Chimpanzees

The chimpanzee (*Pan troglodytes*) and pygmy chimpanzee (*P. paniscus*) are listed by the Fish and Wildlife Service as Threatened species. Pursuant to a petition filed by three wildlife conservation organizations, the Service has initiated a status review for both species to determine whether or not they should be proposed for reclassification as Endangered.

The petition, submitted jointly by the Jane Goodall Institute, World Wildlife Fund, and Humane Society of the United States, was received by the Service on November 4, 1987. It contained information indicating that the status of *P. troglodytes* has deteriorated substantially since it was originally listed as Threatened in 1976. Among the threats this primate is said to face are massive habitat destruction, fragmentation of populations (and associated vulnerability to disease), excessive hunting and capture by people, and inadequate national and international controls. International trade in chimpanzee infants for the biomedical research market is also considered to have a significant impact on the species in the wild.

After examining the petition, the Service concluded that it contains "substantial information indicating that the requested action may be warranted." Accordingly, a status review was begun. Because the related pygmy chimpanzee also inhabits the tropical forests of Africa, it may face the same increased threats; therefore, the Service is including this species in the review. Comments, information, and questions should be sent to the Office of Scientific Authority, Mail Stop 527, Matomic Building, U.S. Fish and Wildlife Service, Washington, D.C. 20240, by July 21, 1988. After considering the information received by that time, the Service will



photo by Geza Teleki, courtesy of World Wildlife Fund

Chimpanzees are thought to be in greater danger than ever before because of widespread habitat loss, excessive take by people, and other threats.

decide whether or not to propose reclassification of both species from Threatened to Endangered.

A decision to reclassify the chimpanzee and/or the pygmy chimpanzee as Endangered would remove the applicability of the special rule for primates [50 CFR 17.40(c)] to these chimpanzee species. Therefore, the Service is interested in

comments as to what, if any, effect the removal of current trade exemptions might indirectly have on the wild populations of these chimpanzees. If the reclassification were warranted but removal of the special rule might impact the wild population, the Service would consider alternative procedures to alleviate restrictions adversely affecting the wild populations.

Riparian Systems Conference

On September 22-24, 1988, University Extension at the University of California—Davis will host the second "California Riparian Systems Conference." This event will report on issues surrounding the destruction of streamside lands and on progress made in learning to manage

these resources since the first conference in 1981. Also discussed will be new concerns for restoration of riparian habitats along disturbed river and creek banks throughout the State.

The conference schedule includes professionally-oriented daytime programs for

Thursday and Friday and seminars to bring professionals, activists, and the general public closer together on riparian issues for the evenings and Saturday. For more information, contact Dana Abell at (916)752-3098.

Approved Plans

(continued from page 4)

protective measures. Research into the life history of the Nashville crayfish must be conducted to efficiently plan any reintroduction activities. Public education is in progress with the development of a slide-tape program for distribution to schools in the Nashville area. This program emphasizes the need to protect environmental quality in Mill Creek, the only known habitat of the Nashville crayfish. Development of this program was a cooperative venture

among the Tennessee Department of Conservation; the U.S. Army Corps of Engineers, Nashville District; Tennessee Wildlife Resources Agency; and the Service. In any public education program, it is imperative not to identify specific locations inhabited by these animals in order to protect them from take for food and for use as fishing bait.

The goals of the plan may be reevaluated as data are generated during the recovery effort. At present, it is considered that complete removal from the protection of the Endangered Species Act is not likely because of the limited popula-

tion and the threats to the habitat. It is hoped, however, that through these recovery efforts reclassification to Threatened status may be feasible in the future.

* * *

Copies of these and all other recovery plans are available for purchase about 6 months after they are approved. Requests should be sent to the Fish and Wildlife Reference Service, 6011 Executive Boulevard, Rockville, Maryland 20852, or call toll-free 800/582-3421. (In Maryland, dial 301/770-3000.)

Sea Otter

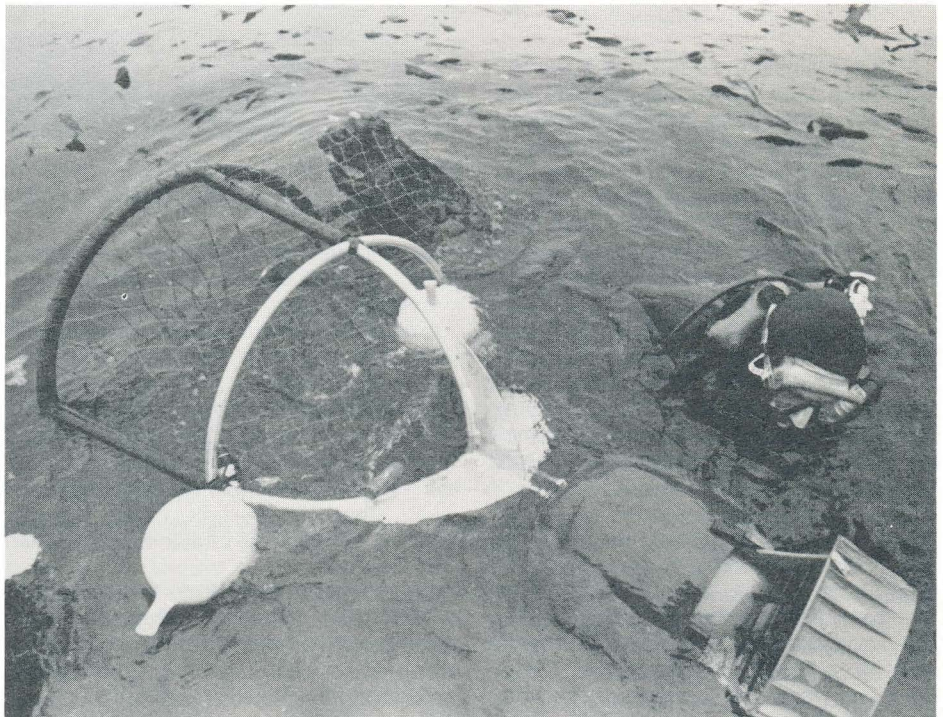
(continued from 1)

As of March 31, we know that 18 sea otters are no longer at San Nicolas Island. Eight of them left the island and returned to the donor population. When another was found in the "no otter" management zone in late December 1987, she was caught and moved back to her original capture site in central California. All nine of these otters are doing fine along the mainland. On the other hand, three males died at San Nicolas from stress related to their capture and transportation. Two females were found dead on beaches in southern California. (One of these had been shot by someone and the other died of undetermined causes.) At least one other translocated otter drowned after becoming entangled in fishing gear, and it is suspected that another three met the same fate. This leaves a theoretical population of 45 animals at the island. Between February 28 and March 28, 1988, 21 of these 45 sea otters were identified at the island.

The other twenty-four animals are considered "missing", including six that were never sighted after their release at the island. The eight that returned to the parent population also were considered missing for periods of time between 26 and 208 days until they were sighted on the mainland. These eight otters represent 25 percent of the 32 otters that at one point or another have been considered missing. We had anticipated that more of the sea otters would stay around San Nicolas Island. It is, however, premature to assume that the 24 animals that are still missing are dead. We are continuing to search for these otters and are optimistic that we will find some of them back in the parent population. However, some may have lost their flipper tags, thus making it impossible to identify them.

By comparing the weights of animals that have remained at San Nicolas Island with those of the otters that have returned to the mainland, we found that small (juvenile) otters are more likely to remain at the island than large (adult) animals. Based on this information, we will be even more selective when choosing otters for transport to San Nicolas Island in the future.

Now (late March), more than 7 months after the new colony of sea otters was created, about a third of the reintroduced animals are routinely sighted around the island. It is still too early to say anything about the success of the translocation; however, as a comparison, it is useful to review the history of another reintroduction effort. Fifty-nine sea otters from Alaska were released during 1969 and 1970 along the State of Washington's coastline. At least 16 of the 29 released in 1969 died within 2 weeks. No data are available on deaths after the second re-



Dip nets (above) and underwater traps operated by SCUBA divers (below) were two of the methods used to capture California sea otters for translocation.

lease of 30 sea otters in 1970. Very few data on the reintroduced animals were recorded until 1977, when Service biologists conducted the first intensive survey. At that time, only 19 otters, including 4 pups, were observed. Population surveys during the 1980's suggest that the Washington population has been slowly increasing. Total counts in 1981, 1983, 1985, and 1987 were 36, 52, 65, and 94, respectively. Thus, barring any disasters, it appears that the sea otter population off Washington is established and should continue to grow.

If the Washington reintroduction can be used as an example, it could take at least 5 years before the new colony at San Nicolas Island shows evidence of growth. However, for the San Nicolas Island reintroduction, the Service has the option to move up to 250 otters from the parent population to assist in this effort. By moving additional smaller sea otters to San Nicolas Island, we hope to establish a self-sustaining colony there in less than 5 years. If the reintroduction is a long-term success, it will be a giant step toward the recovery of the California sea otter.

photos by Jeff Foot

Marine Mammal Report Available

The Fish and Wildlife Service has issued its annual report for calendar year 1986 on administration of marine mammals under its jurisdiction, as required by section 103(f) of the Marine Mammal Protection Act of 1972. The report contains accounts on eight mammals: the polar bear (*Ursus maritimus*), walrus (*Odobenus rosmarus*), dugong (*Dugong dugon*), West Indian manatee (*Trichechus man-*

atus), Amazonian manatee (*T. inunguis*), West African manatee (*T. senegalensis*), marine otter (*Lutra felina*), and sea otter (*Enhydra lutris*). [The southern sea otter (*E. l. nereis*), marine otter, dugong, and all three manatees also are listed under the Endangered Species Act.]

Administrative actions discussed in the report include Endangered and Threatened species (particularly the West Indian

manatee and the southern sea otter in California), marine mammals in Alaska, law enforcement, scientific and public display permits, research, Outer Continental Shelf environmental studies, international activities, and appropriations.

Copies of the report are available by writing to the Publications Unit, U.S. Fish and Wildlife Service, 148 Matomic Building, Washington, D.C. 20240.

Regulations Proposed for Incidental Take of Marine Mammals

In the March 15, 1988, *Federal Register*, the U.S. Fish and Wildlife Service (Department of the Interior) and the National Marine Fisheries Service (Department of Commerce) jointly published regulations to implement recent amendments to the Endangered Species Act and the Marine Mammal Protection Act (MMPA). These amendments provide a

legal mechanism for allowing certain incidental takings of Endangered, Threatened, or "Depleted" marine mammals. Previously, incidental take of marine mammals designated as Depleted was not allowed under the MMPA. The amendments were designed to make the two laws more consistent, and the proposed changes in the regulations would

implement these amendments.

A discussion providing background and details on this issue was published with the proposal. Comments on the proposed changes should be sent to the Director, Office of Protected Resources and Habitat Programs, National Marine Fisheries Service, Washington, D.C. 20235, by May 16, 1988.

Regional News

(continued from page 2)

tern was listed by the Service in 1985 as Endangered due to declining numbers. River modification resulting from such activities as dam construction, channelization, navigation and hydropower projects, and water withdrawals for irrigation, has caused loss and degradation of tern breeding habitat. Least terns nest on barren to sparsely vegetated beaches, including salt flats, sand and gravel bars, spits, and islands. High quality breeding areas with adequate food available are in short supply, and terns frequently must compete with people who use the remaining beach space for recreation. Human-related disturbances at tern colonies can be devastating. Unattended eggs and chicks overheat in the sun or are crushed by people, their vehicles, pets, and livestock.

The joint recovery project will focus on increasing public awareness of least terns. In addition to encouraging television and newspaper coverage of terns during the breeding season, and enlisting the help of Scout Troops in building and placing chick shelters at tern colonies, recovery project members will develop a pamphlet and narrated videotape on the tern. The pamphlet and video should be available for distribution by the end of Fiscal Year 1988. Anyone wishing to receive copies of the pamphlet and a loan of the video should contact Laura Hill at the Tulsa Field Office, U.S. Fish and Wildlife Service, 222 S. Houston Avenue, Suite A, Tulsa, Oklahoma 74127; telephone 918/581-7458 or FTS 745-7458.

* * *

The Dawson and Nebraska Public Power Districts, both located in central Nebraska, have agreed to cooperate in evaluating powerline markers that might

reduce bird collisions. Twelve-inch, bright yellow aeronautical balls were installed on company lines with which sandhill cranes (*Grus canadensis*) frequently collided along the Platte River, Nebraska. The Service's Wyoming Cooperative Fishery and Wildlife Research Unit will monitor crane collisions on marked and unmarked lines for the next 2 to 3 years to see if markers reduce collision frequency. The resulting data will have application to the recovery of whooping cranes (*Grus americana*) because collisions with powerlines are the number one known cause of death of free-flying whoopers. This research will complement a study in Colorado that is testing another marker in differing habitat conditions where the line collisions are predominantly by geese and ducks.

* * *

Whooping cranes occurred in the southeast and wintered on portions of the Atlantic coast in the 19th century. The U.S. Whooping Crane Recovery Plan has a goal of establishing three wild, self-sustaining populations, including one in eastern North America, so that the species may be reclassified from the Endangered category to Threatened. In 1983, the recovery team recommended research at potential reintroduction areas in the upper peninsula of Michigan and adjacent Ontario, Canada; Okefenokee Swamp in southern Georgia; and three sites in central Florida. Project leaders reported on their studies at the recovery team meeting in February. The recovery team has now narrowed the candidate release sites to Kissimmee Prairie in Florida and the Okefenokee Swamp. Both sites would be suitable for attempting to establish a nonmigratory whooping crane population like that which survived in Louisiana into the 1940's. Captive-reared whoopers would be introduced using the "gentle release" technique that has been

successful in supplementing the wild population of the Endangered Mississippi sandhill crane (*Grus canadensis pulla*) in Jackson County, Mississippi. Specific selection of a proposed release site will occur in summer 1989, and the first birds could be released as early as 1991.

* * *

Region 6 — During the week of February 22-26, 1988, approximately 300 people attended public meetings in Libby, Troy, Trout Creek, Thompson Falls, and Kalispell, Montana, on a proposal to test augmentation of the grizzly bear (*Ursus arctos*) population in the Cabinet-Yaak ecosystem by adding 4 to 8 grizzly bears to the estimated 15 bears that now live there. The proposal is intended to help meet the grizzly bear recovery goal for the Cabinet-Yaak ecosystem. The 60-day comment period closed on March 31, 1988. After comments are organized and evaluated, a decision will be made on whether or not to proceed with the proposal.

* * *

Region 6 recently assembled a group of four biologists in the Grand Island, Nebraska, Office to be known as the "Platte River Task Group." The Group is charged with conducting studies and other activities related to the recovery of four Threatened and Endangered bird species (whooping crane; bald eagle; interior least tern; and piping plover, *Charradius melodus*) on the Platte River.

* * *

The second meeting of the Black-Footed Ferret Interstate Coordinating Committee was held in Northglenn, Colorado, March 8-9, 1988. Representatives of 9 of the 12 States within the potential range of the ferret (*Mustela nigripes*) were in attendance. The committee will be expanded to involve a national represent-

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Regional News

(continued from page 7)

ative from Federal land management agencies. The Coordinating Committee serves as an advisor to the Regional Director of the Fish and Wildlife Service in Denver, who has lead responsibility to coordinate recovery of the black-footed ferret throughout its potential range. For now, captive breeding appears to be the best strategy for recovery of the species. There are no known ferrets in the wild at this time. The Committee met to discuss programs and problems involved in identifying, evaluating, and ranking ferret habitat (prairie dog ecosystems) for possible reintroduction of captive-reared black-footed ferrets in 1991.

* * *

Region 7 — The recent listing of the Aleutian shield-fern (*Polystichum aleuticum*) as Endangered marks the first listing of a plant in Alaska. Despite surveys in each of the past 4 years, one population consisting of only 6 plants comprises the current known world population for the species. However, because this plant occurs at high elevations on remote Aleutian islands, the Service is optimistic that additional specimens will be found. Toward this end, three teams of botanists will be conducting surveys this July and August on several of the Aleutian Islands, including Attu, Unalaska, Atka, and Adak. The shield-fern is without close relatives in North America and appears to be a relict of preglacial times.

* * *

Region 8 (Research) — This year to date (March 25), three captive pairs of Puerto Rican parrots (*Amazona vittata*) at the Puerto Rico Research Station aviary have produced fertile eggs. This includes two of the four fertile pairs from 1987 and an additional captive pair. The production of fertile eggs from this additional pair is very important from a genetic standpoint.

BOX SCORE OF U.S. LISTINGS AND RECOVERY PLANS								
Category	ENDANGERED			THREATENED			SPECIES* TOTAL	SPECIES WITH PLANS
	U.S. Only	U.S. & Foreign	Foreign Only	U.S. Only	U.S. & Foreign	Foreign Only		
Mammals	28	19	240	3	3	23	316	23
Birds	61	15	145	7	3	0	231	55
Reptiles	8	7	59	14	4	14	106	21
Amphibians	5	0	8	4	0	0	17	6
Fishes	41	2	11	25	6	0	85	45
Snails	3	0	1	5	0	0	9	7
Clams	29	0	2	0	0	0	31	21
Crustaceans	5	0	0	1	0	0	6	1
Insects	8	0	0	7	0	0	15	12
Plants	139	6	1	31	3	2	183	56
TOTAL	327	49	467	97	19	39	998	263 **
<div> <div>Total U.S. Endangered 376</div> <div>Total U.S. Threatened 116</div> <div>Total U.S. Listed 492</div> </div> <div> <div>Recovery Plans approved: 223</div> <div>Species currently proposed for listing: 17 animals</div> <div>31 plants</div> </div>								
<p>* Separate populations of a species that are listed both as Endangered and Threatened are tallied twice. Those species are: the leopard, gray wolf, bald eagle, piping plover, roseate tern, Nile crocodile, green sea turtle, and olive Ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.</p> <p>** More than one species are covered by some recovery plans, and a few species have separate plans covering different parts of their ranges.</p> <p>Number of Cooperative Agreements signed with States and Territories: 51 fish & wildlife April 30, 1988 36 plants</p>								

The male was caught in the wild in the early 1970's and is thought to be the only representative of his family line in the captive flock.

* * *

In February, 10 palilas (*Loxioides bailleui*) were captured and fitted with miniature radio transmitters prior to release.

The birds will be tracked at the Mauna Kea study area on the island of Hawai'i daily for up to 28 days, which is the expected life of the transmitter batteries. This study will provide researchers with information on home-range and movement patterns of individual birds during the pre-breeding period.

April 1988

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ENDANGERED SPECIES

Technical Bulletin

Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 20240

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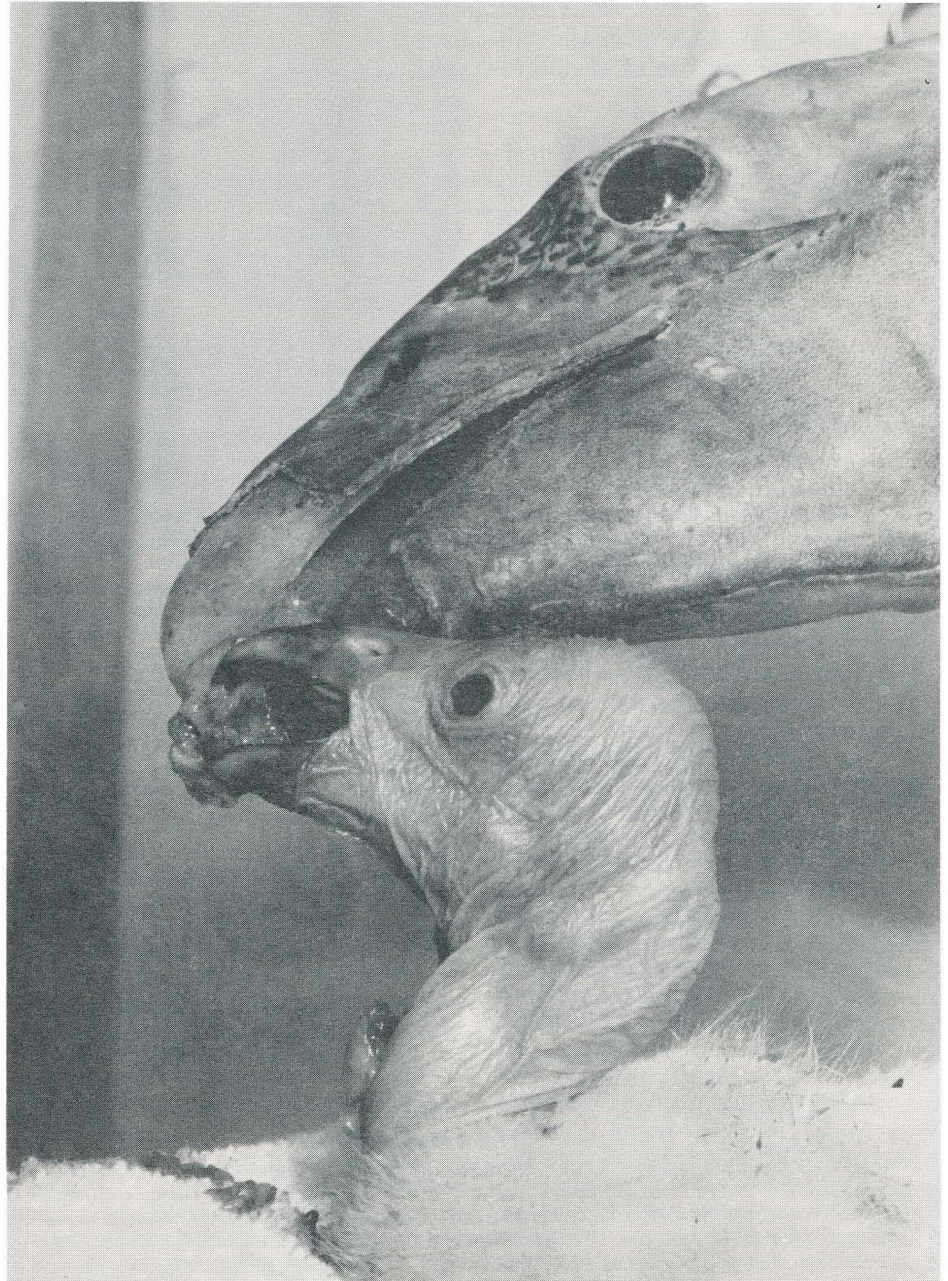
California Condor Population Grows by One

The first California condor (*Gymnogyps californianus*) chick ever conceived in captivity hatched in an incubation chamber at San Diego Wild Animal Park on April 29, marking a turning point in efforts to save the critically endangered species. This event brings the cooperative recovery program one step closer to the day when California condors can be released back into their native habitat.

The chick, which was given the name "Molloko" (a Maidu Indian word for condor), hatched after a 57-day incubation at the zoological park. Veterinarians said the chick's condition was good and it appeared strong. Attendants helped the chick emerge from the shell and removed the last fragments 61½ hours after it first started to hatch. Four days later, zookeepers introduced the chick to its surrogate parent, a hand puppet designed to look like the head of an adult condor. Using the puppet, keepers feed the chick minced mice and regurgitated vulture food. When the chick is about one month old, it will be transferred to outdoor facilities where the other condors are housed. At that time, veterinarians will decide whether or not it is an appropriate time for blood tests to determine its sex.

After the egg was laid on March 3, it was removed from the cage housing its parents in order to stimulate them to produce another egg. Although the pair resumed mating activities the next day, no additional eggs have been produced. Biologists are hoping for greater success next year. California condors in the wild have shown the ability to produce up to three eggs in a season to replace ones that are lost.

Four of the last five known California condor breeding pairs in the wild disappeared over the winter of 1984–1985. The Fish and Wildlife Service then decided that bringing the few remaining birds into a captive breeding program, thereby increasing their numbers, was the best chance to avert the species' extinction while investigations continue into the mortality of condors in the wild. The last free-flying condor was captured on the Bitter Creek National Wildlife Refuge in 1987. In addition to the new chick, there are now 27 California condors in



California condor chick Molloko receives a meal of minced mice from its "puppet parent" at San Diego Wild Animal Park.

existence; 14 are housed in breeding facilities at the San Diego Wild Animal Park and 13 are similarly cared for at the

Los Angeles Zoo. The combined population is composed of 13 males and 14 females.

photo by Craig W. Racot, courtesy of Zoological Society of San Diego



Regional News

Regional endangered species biologists have reported the following recent news and activities:

Region 1 - An Environmental Assessment evaluating a temporary, experimen-

tal release of same-sex, captive-bred Andean condors (*Vultur gryphus*) in the southern California range of the California condor (*Gymnogyps californianus*) was distributed recently to 260 State, Federal, and private reviewers for a 30-day com-

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Region 5, One Gateway Center, Suite 700, Newton Corner, MA 02168 (617-965-5100); Ronald E. Lambertson, *Regional Director*; Ralph Pisapia, *Assistant Regional Director*; Paul Nickerson, *Endangered Species Specialist*.

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Region 8, (FWS Research and Development), Washington, D.C. 20240; Richard N. Smith, *Regional Director*; Bettina Sparrowe (202-653-8762), *Endangered Species Specialist*.

U.S. Fish and Wildlife Service Regions

Region 1: California, Hawaii, Idaho, Nevada, Oregon, Washington, American Samoa, Commonwealth of the Northern Mariana Islands, Guam, and the Pacific Trust Territories.

Region 2: Arizona, New Mexico, Oklahoma, and Texas. **Region 3:** Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. **Region 4:** Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Puerto Rico, and the U.S. Virgin Islands. **Region 5:** Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia. **Region 6:** Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, and Wyoming. **Region 7:** Alaska. **Region 8:** Research and Development nationwide.

The ENDANGERED SPECIES TECHNICAL BULLETIN is published monthly by the U.S. Fish and Wildlife Service, Department of the Interior, Washington, D.C. 20240.

ment period. The proposed research task is designed to test release techniques, evaluate and select suitable release sites, and train personnel. Released birds will be equipped with radio tags to allow tracking and gathering of behavioral data. The information gained will be used when captive-bred California condors are eventually released to the wild.

Regional staff members attended the annual Desert Tortoise Council meetings in Laughlin, Nevada, March 26-29, 1988. The major issues of interest covered at the meeting included conservation biology theory applied to the desert tortoise (*Xerobates agassizii*), the Bureau of Land Management's (BLM) new plan to manage the tortoise's habitat on BLM lands, some specific planned projects that will have a significant impact on the tortoise, discussion on the genetic and morphometric differences of the three apparently distinct populations, and status reports.

Senior Staff Biologist John Ford of the Honolulu, Hawaii, Field Office was nominated by Hawaii Governor John Waihee to a 4-year term as a member of the Natural Area Reserves System Commission. State Senate confirmation is expected shortly.

Region 2 - CBS Evening News gave coverage to the avian cholera outbreak among waterfowl in the San Luis Valley, Colorado, in February and the possible threat to whooping cranes (*Grus americana*). An estimated 6,000 ducks and geese died. Over 20 sandhill crane (*Grus canadensis*) carcasses were recovered but no whooping cranes were known to be affected. Knowledge of the problem in the San Luis Valley allowed Bosque del Apache National Wildlife Refuge in New Mexico to provide supplemental grain to whooping cranes, holding them in New Mexico for about 2 weeks longer than normal. The disease outbreak was over in late March when mild weather allowed the birds to disperse to many roost sites and made food more accessible.

The Canadian Whooping Crane Recovery Plan was published recently by the Canadian Wildlife Service. This plan complements the U.S. recovery plan and emphasizes actions within the boundaries of Canada. The Canadian Whooping Crane Recovery Team is the first recovery team organized in Canada and the plan is the first prepared for recovery of an endangered species in Canada. Copies are available from Dr. James Lewis, Whooping Crane Coordinator, U.S. Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103.

Seventy-six seedlings of Kearney's blue-star (*Amsonia kearneyana*) were planted on a private ranch in a remote canyon of the Baboquivari Mountains
(continued on page 10)

Endangered Species Act Protection is Proposed for Nine Species

During April 1988, three species of plants and six species of invertebrate animals were proposed by the Fish and Wildlife Service for Federal listing as Endangered or Threatened. If the proposals are made final, Endangered Species Act protection will be extended to the following:

Alabama Canebrake Pitcher-plant (*Sarracenia rubra* ssp. *alabamensis*)

Some of the rarest and most unusual plants of the southeast are the pitcher plants, carnivorous species that trap and digest insects within hollow leaves or "pitchers." These plants grow only in open, boggy sites, a limited type of habitat that is rapidly being modified for agriculture and other purposes. Threats to pitcher plants also come from collectors, who are attracted to these species by their scarcity and distinctive feeding habits. As a result, the Service has taken action to give the most vulnerable taxa protection under the Endangered Species Act. The green pitcher plant (*Sarracenia oreophila*) is listed as Endangered, and the same status recently was proposed for the mountain sweet pitcher plant (*Sarracenia rubra* ssp. *jonesii*). (See story in BULLETIN Vol. XIII No. 3.) Now, the Service has proposed to list a related taxon, the Alabama canebrake pitcher plant, (*Sarracenia rubra* ssp. *alabamensis*) as Endangered (F.R. 4/21/88).

The Alabama canebrake pitcher-plant occurs in sandhill seeps, swamps, and bogs along the fall-line of central Alabama. It requires sunny areas with little competition from woody vegetation. Historically, this subspecies was reported from 27 sites, but 16 of them have been destroyed through habitat alteration (e.g., drainage and conversion to cropland or pasture), herbicide application, over-collecting, and/or vegetational succession (due to suppression of naturally-occurring wildfires).

Extensive searches of potential habitat over the past 20 years indicate that only 11 populations remain—5 in Chilton County, 4 in Autauga County, and 2 in Elmore County. All are on private lands. Only 3 of the remaining 11 populations are of significant size (50 or more plants). Two of these three sites face imminent threats, one from gravel mining and the other from drainage.

Taking is another well-documented threat to the Alabama canebrake pitcher plant. Collecting by commercial plant dealers and hobbyists has contributed to the destruction of several historical populations and significantly depleted many others. In 1975, one collector even ran an advertisement in a local newspaper offer-



Alabama canebrake pitcher-plant (*Sarracenia rubra* var. *alabamensis*)

ing a reward for pitcher plant locations and specimens. Listing *S. r.* ssp. *alabamensis* as Endangered would not prohibit taking of this plant on State or private lands, but it would restrict interstate trade.

Major landowners have been contacted about the presence of the Alabama canebrake pitcher plant on their property and informed about land uses compatible with its survival. Several owners have been very receptive to protection, and efforts are under way to enlist the support of others. Suggested habitat management techniques include the use of prescribed burning or manual clearing in order to maintain the open sites needed by the pitcher plant.

Comments on the proposal to list the Alabama canebrake pitcher plant as Endangered are welcome and should be sent to the Jackson Field Office, U.S. Fish and Wildlife Service, Jackson Mall Office Center, Suite 316, 300 Woodrow Wilson Avenue, Jackson, Mississippi 39213, by June 20, 1988.

Cooley's Meadowrue (*Thalictrum cooleyi*)

As its common name indicates, Cooley's meadowrue is a plant found in open sites.

This small herb in the buttercup family (Ranunculaceae) is endemic to a few areas of the southeastern coastal plain, where it inhabits wet savannas, bogs, and other sunny, moist locations. Habitat modification and the direct application of herbicides threaten this plant's survival, and the Service has proposed to list it as an Endangered species (F.R. 4/21/88).

T. cooleyi is a rhizomatous perennial with narrow, lance-shaped leaves. Its stems, which seldom reach more than 40 inches (one meter) in height, are erect in the full sun but sometime sprawling when in shade. A dioecious species, Cooley's meadowrue bears separate male and female flowers. Both types of flowers are very small and lack petals, but the staminate (male) blossoms have yellowish to white sepals with lavender filaments and the pistillate (female) flowers have greenish sepals. The dioecious nature of *T. cooleyi* further increases the vulnerability of very small populations in which plants of only one sex may remain.

Historically, 15 populations of Cooley's meadowrue were reported from 7 counties in North Carolina, Georgia, and Florida. Only 10 are known to survive, one in Florida (Walton County) and the rest in North Carolina (Columbus, Onslow, and Pender Counties). All 10 are on privately owned land, although The Nature Conservancy owns part of one site in Pender County. The extirpated populations are believed to have succumbed as a result of fire suppression and silvicultural/agricultural activities. These and other threats, such as mining, drainage, road construction, and herbicide use, pose danger to the remaining populations.

Because *T. cooleyi* is shade-intolerant, it depends on wildfires or certain other kinds of disturbance to maintain the open, sunny areas upon which the species depends. It is no accident that seven of the current populations are along roadsides or in powerline rights-of-way. Fire suppression has allowed shrubs and trees to encroach on some *T. cooleyi* sites, making the habitat too shady for this species. As a substitute for fire, certain other kinds of disturbance, such as mowing and logging, can open up habitat for the meadowrue if properly done; however *T. cooleyi* cannot survive bulldozing, drainage, conversion of habitat to pine plantations, or the direct application of herbicides.

North Carolina already lists Cooley's meadowrue under State law as endangered, a classification that prohibits take without landowner permission and interstate trade without a permit. A Federal listing would complement this protection

(continued on page 4)

photo by Randy Troup

Nine Species

(continued from page 3)

and further encourage conservation of the species.

Comments on the Service's proposal to list Cooley's Meadowrue as a Threatened species are welcome and should be sent to the Asheville Field Office, U.S. Fish and Wildlife Service, 100 Otis Street, Room 224, Asheville, North Carolina, by June 20, 1988.

Dwarf-flowered Heartleaf (*Hexastylis naniflora*)

A herbaceous plant in the birthwort family (Aristolochiaceae), *H. naniflora* is known from only 24 populations in an 8-county area of the upper piedmont of North Carolina and adjacent South Carolina. The dark green, leathery, heart-shaped leaves are supported by long thin petioles arising from a subsurface rhizome. Its maximum height rarely exceeds 6 inches (15 centimeters). The usually beige to dark brown jug-shaped flowers, which appear from mid-March to early June, are small and inconspicuous. The dwarf-flowered heartleaf differs from other members of the genus *Hexastylis* by its small flowers and its habitat in acidic soils along bluffs and adjacent slopes, in boggy areas next to streams and creekheads, and along the slopes of nearby hillsides and ravines.

Three of the 24 populations currently receive some form of protection. Most of the largest South Carolina population, which contained over 4,000 plants until 64 percent were destroyed by construction of a reservoir, is now being protected by the City of Spartanburg. Two of the larger North Carolina populations are registered natural areas receiving short-term protection under that State's Natural Heritage Program. However, since these registry agreements are nonbinding, both sites remain vulnerable in the long term. The remaining populations of dwarf-flowered heartleaf are threatened by alteration or loss of habitat from conversion to pasture, grazing, intensive timber harvesting, residential construction, and construction of small ponds at former creekheads.

A natural factor affecting the vigor of some populations is the fact that their preferred habitat is often shared by dense stands of mountain laurel (*Kalmia latiflora*) or *Rhododendron* spp., which reduce the amount of light reaching the low-growing *H. naniflora*. In such situations, selective logging could benefit these heartleaf populations by opening them up to more light, provided that increased siltation from the intensive soil disturbances associated with forest clear-cutting is avoided.

In North Carolina, *H. naniflora* is listed under State law as endangered. Such plants are protected from interstate trade without a permit, and the State statute also provides for monitoring and management. South Carolina currently offers no



dwarf-flowered heartleaf (*Hexastylis naniflora*)

photo by Robert R. Currie

official protection, although the dwarf-flowered heartleaf is unofficially recognized as an endangered component of the State's flora. The Service's April 21, 1988 proposal to list *H. naniflora* at the Federal level as a Threatened species, if finalized, will provide for additional protection and recovery activities.

Comments on this listing proposal are welcome, and should be sent to the Asheville Field Office by June 20, 1988.

Little-wing Pearlymussel (*Pegias fabula*)

The little-wing pearlymussel, the sole member of its genus, is a small freshwater mollusk whose size does not exceed 1.5 inches (3.8 cm) in length and 0.5 inch (1.3 cm) in width. The shell's outer surface is often eroded, giving it a chalky or ashy white appearance. Like other freshwater mussels, this species feeds by filtering food particles from the water. Its reproductive cycle includes an early larval stage when the mussel larvae (glochidia) probably attach to the gills or fins of a fish and transform into juvenile mussels. The young mussels then drop off to the stream substrate where, if conditions are favorable, they grow to maturity. The specific host fish for *P. fabula* and many other aspects of this mussel's life history are unknown.

Pegias fabula inhabits clear, cool, free-flowing streams and is usually found in the transitional zone between riffles and pools. The species has been recorded historically from 27 stream reaches in Alabama, North Carolina, Kentucky, Tennessee, and Virginia, all of them within the Tennessee and Cumberland River drainages. Based on extensive surveys of historical and potential habitat, however, it has been reduced in range to only six

short reaches—three in southeastern Kentucky, two in southwestern Virginia, and one in central Tennessee. On April 21, 1988, the Service proposed listing *P. fabula* as an Endangered species.

Habitat loss and water quality deterioration are the primary reasons for the sharp decline of the little-wing pearlymussel. Some sites were flooded by impoundments. Others were degraded by industrial and municipal pollution, siltation from certain mining or agricultural practices, or other land disturbances within the drainage. Most of these factors threaten the remaining six *P. fabula* populations. The Service has no evidence that further mining, if conducted in accordance with Federal and State regulations, is a threat to the mussel. Unregulated mining operations in the past, however, did contribute to the decline, and current activities not in compliance with appropriate regulations may be a threat.

Comments on the listing proposal are welcome, and should be sent to the Asheville Field Office by June 20, 1988.

Five Texas Cave Invertebrates

Five species of small, cave-dwelling invertebrate animals in Texas are believed to be vulnerable to extinction due to the projected impacts of development on their limited habitat. Each is restricted to six or fewer small, shallow, dry caves near the city of Austin. To help prevent the loss of these species, the Service has proposed listing the following as Endangered (F.R. 4/19/88):

• **Tooth Cave pseudoscorpion (*Microcreagris texana*)** — Resembling a tiny, tailless scorpion, this species reaches a maximum length of only 4 millimeters

(continued on next page)

(approximately $\frac{3}{16}$ inch). It lacks both eyes and a stinger, and is harmless to humans, though it uses its pincers to prey on small insects and other arthropods. The only known sites for this animal are Tooth and Amber Caves, both in Travis County.

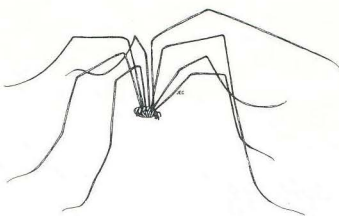
● **Tooth Cave spider (*Leptoneta myopica*)** — An even smaller creature, the Tooth Cave spider is 1.6 mm (about $\frac{1}{16}$ inch) in body length. This spider is sedentary, spinning webs from the ceiling and walls of Tooth Cave, its only habitat. Although it is never found outside the cave, it does have rudimentary eyes.

● **Bee Creek Cave harvestman (*Texella reddeni*)** — This light yellowish-brown harvestman has relatively long legs that extend from a small body (2 mm, or less than $\frac{1}{16}$ inch, in length). It is eyeless and probably predatory on small insects. *T. reddeni* is known from Tooth, Bee Creek, McDonald, Weldon, and Bone Caves in Travis and Williamson Counties.

● **Tooth Cave ground beetle (*Rhadine persephone*)** — Only marginally larger than the other invertebrates in the listing proposal, this species has a reddish-brown body 7-8 mm (about $\frac{5}{16}$ inch) long. Like the spider above, the Tooth Cave ground beetle has rudimentary eyes. It probably feeds on the eggs of cave crickets. *R. persephone* is known only from Tooth and Kretschmarr Caves in Travis County.

● **Kretschmarr Cave mold beetle (*Texamaurops reddeni*)** — This eyeless, dark-colored beetle with elongated legs measures less than 3 mm (approximately $\frac{1}{8}$ inch) in length. It is known from Kretschmarr, Tooth, Amber, and Coffin Caves in Travis and Williamson Counties.

The caves inhabited by all five of these invertebrates are small. McDonald Cave, the largest, consists of less than 60 meters (about 200 feet) of passage, and most of the others are considerably smaller. They occur as "islands" of cave habitat within the Edwards Limestone formation. Their isolation has resulted in the evolution of highly localized and distinct cave faunas. In addition to the five spe-

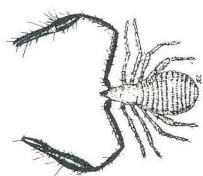


Harvestmen, sometimes referred to as "daddy longlegs," have a small, roundish body and eight long, thin legs.

cies proposed for listing, these caves and others in the area support a number of other uncommon and scientifically significant species.

The proximity of the caves to the city of Austin makes them vulnerable to the continued expansion of the metropolitan area. The main threat to the five cave invertebrates is the potential loss or degradation of their habitat from anticipated road construction, residential and commercial development, and industrial projects. Without proper safeguards, such activities could fill or collapse the shallow caves; alter drainage patterns that affect cave habitat; introduce exotic competitive and predatory organisms (e.g., cockroaches, sowbugs); and pollute the cave systems with pesticides, fertilizers, oils, and other harmful runoff. Development may already have claimed at least one site; Coffin Cave was not even found during recent survey attempts.

Comments on the listing proposal are welcome and should be sent to the Regional Director, Region 2 (address on BULLETIN page 2), by June 20, 1988.



Pseudoscorpions are tiny, harmless arachnids that somewhat resemble the larger true scorpions but lack the elongate tail, poison bulb, and stinger.

Conservation Measures Authorized by the Endangered Species Act

Among the conservation benefits provided to a species if its listing under the Endangered Species Act is approved are: protection from adverse effects of Federal activities; restrictions on take and trafficking; the requirement for the Service to develop and implement recovery plans; the authorization to seek land purchases or exchanges for important habitat; and the possibility of Federal aid to State or Commonwealth conservation departments that have signed Endangered Species Cooperative Agreements with the Service. Listing also lends greater recognition to a species' precarious status, which encourages further conservation efforts by State and local agencies, independent organizations, and individuals.

Section 7 of the Act directs Federal agencies to use their legal authorities to further the purposes of the Act by carrying out conservation programs for listed species. It also requires these agencies to ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the survival of a listed species. If an agency finds that one of its activities may affect a listed species, it is required to consult with the Service on ways to avoid jeopardy. For species that are proposed for listing and for which jeopardy is found, Federal agencies are required to "confer" with the Service, although the results of such a conference are non-binding.

Further protection is authorized by Section 9 of the Act, which makes it illegal to take, possess, transport, or engage in interstate or international trafficking in listed animals except by permit for certain conservation purposes. For plants, the rule on take is different; the prohibition against collecting applies only to listed plants found on lands under Federal jurisdiction. Some States, however, have their own more restrictive laws against take of listed plants.

Listings Approved for Three Plants

Final listing rules were published recently for three species of plants, bringing Endangered Species Act protection to the following:

● **Relict trillium (*Trillium reliquum*)** — This herbaceous member of the lily family produces early spring flowers that are usually greenish to brownish-purple. Only 10 populations are known to exist—2 in Alabama, 3 in South Carolina, and 5 in Georgia. Habitat disturbance resulting from logging, urbanization and other development, and fire is the main threat to the relict trillium's survival. It was proposed in the January 14, 1987, *Federal Register* for listing as an Endangered species (see story in BULLETIN Vol. XII

No. 2), and the final rule was published April 4, 1988.

● **Palo de Nigua (*Cornutia obovata*)** — An evergreen tree endemic to Puerto Rico, *C. obovata* declined with the widespread deforestation of the island. Only seven individuals of this species currently are known to survive at two widely separated sites. Any further losses could lead to its extinction. The Service proposed on April 24, 1987, to list *C. obovata* as Endangered (see BULLETIN Vol. XII No. 5), and the final rule was published April 7, 1988.

● **White-haired goldenrod (*Solidago albopilosa*)** — This herbaceous perennial is known only from the Red River Gorge area of Daniel Boone National Forest in

eastern Kentucky. It is usually found in rockhouses (natural, shallow, cave-like formations) and beneath overhanging ledges. Because these same features are very popular for recreation, the goldenrod is subject to intensive disturbance. Management efforts to divert recreation to other areas of the gorge are needed. To help prevent the species' extinction, the Service proposed on April 24, 1987, to list it as Endangered (see BULLETIN Vol. XII No. 5). Information gained since then indicates that the species' status, though still vulnerable, is not as critical as once thought. Accordingly, the Service gave it the classification of Threatened in the April 7, 1988, final rule.

Saving the Masked Bobwhite

Robert R. Gabel
Patuxent Wildlife Research Center
and
Steven J. Dobrott
Buenos Aires National Wildlife Refuge

The masked bobwhite (*Colinus virginianus ridgwayi*) is one of 21 subspecies of bobwhites in North America. It once ranged from southern Arizona to south-central Sonora, Mexico, but was extirpated from the United States by about 1900. Although some ornithologists believed it to be extinct during the 1950's and early 1960's, the masked bobwhite survived in small, isolated populations in Sonora.

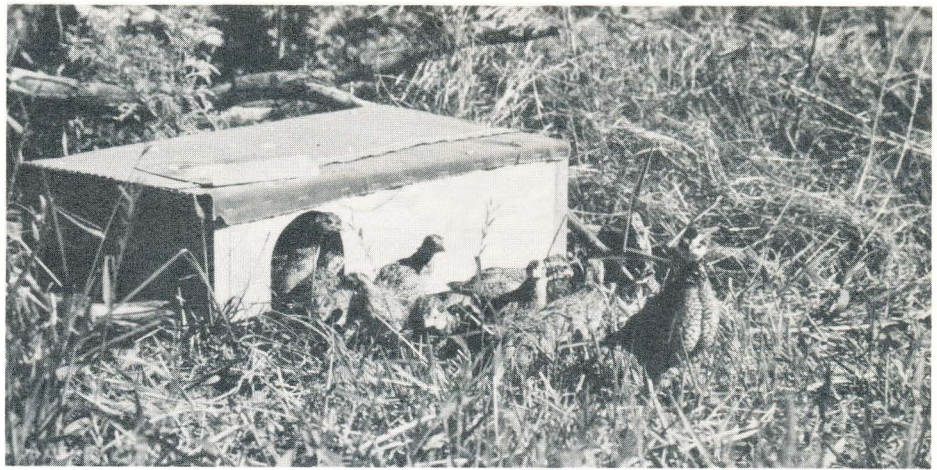
The masked bobwhite tolerates only light grazing pressure on its arid grassland habitat, and its decline is directly attributable to the rapid expansion of the cattle industry in Arizona from 1870 to 1890. In many areas, little vegetation remained after grazing, particularly during the drought-stricken years of 1891-1893. With its habitat severely reduced, the masked bobwhite retreated. Livestock grazing persists today as a threat to the survival of masked bobwhites in Mexico.

A recovery program for the masked bobwhite began in 1966 when the Patuxent Wildlife Research Center in Laurel, Maryland, established a captive breeding colony and began developing the ability to produce large quantities of healthy birds for release into the wild. Biologists at Patuxent's Arizona Field Station conducted studies of the bird's habitat requirements and distribution, and developed release techniques, from 1967 to 1978. In 1985, the Buenos Aires National Wildlife Refuge in southeastern Arizona was established to restore and preserve habitat for the masked bobwhite. Captive-produced birds have been released at the refuge annually since then.

Captive Propagation

The captive breeding program at Patuxent started with the acquisition of four captive-bred pairs from private breeders. These birds had low fertility and hatch rates, along with high chick mortality, presumably because they were from inbred stock that was several generations removed from the wild. To improve the genetic quality of the captive flock, 57 additional wild birds were caught in Mexico and shipped to Patuxent in 1968 and 1970. Successful reproduction soon followed, and approximately 3,000 chicks are now produced annually.

The captive management program for masked bobwhites combines basic gamebird husbandry with research findings. Early research was conducted with



release of a Texas bobwhite male foster parent with a covey of 4-week-old masked bobwhite chicks

masked bobwhites and non-endangered northern bobwhite (*C. v. virginianus*) surrogates. Findings on nutritional requirements of the quail led to the development of optimal diets. Automatic light timers are used to simulate natural daylength and thereby stimulate egg production at appropriate times of the year. Medications are incorporated into the feed to prevent bacterial and parasitic infections. One of the most important aspects of the captive propagation program, however, is genetic management.

Because the masked bobwhite has a relatively short lifespan and generation interval, and because the captive population is derived from relatively few birds, the genetic integrity of the captive flock must be strictly maintained to prevent the loss of genetic diversity over time. To accomplish this, a computer-assisted pedigree and mate-selection program was established in 1982. Using this program, inbreeding is minimized and representation of the original founding animals is carried through from one generation to the next. This system has restricted inbreeding per generation to well below the one-percent level recommended by many



An adult masked bobwhite male in the wild exhibiting the solid breast coloration and nearly all black head present in this subspecies.

population geneticists. In addition, biochemical analyses have demonstrated that the captive population of masked bobwhites has retained a level of genetic diversity comparable to that of other bobwhite subspecies. Reproductive characteristics (fertility, hatch rates, and chick mortality) also show no apparent effects of inbreeding.

In 1986, to further improve the genetic quality of the captive flock, 18 additional masked bobwhites were caught in Mexico and brought to Patuxent. This was the first influx of "new blood" since 1970. Most of these birds produced young that same year, thus adding additional founder animals and greater genetic diversity among the captive birds.

Reintroductions in Arizona

From 1937 to 1950, numerous attempts were made to establish masked bobwhites in Arizona and New Mexico by releasing either pen-reared birds or wild bobwhites captured in Mexico. Unfortunately, most of these releases were made outside of the masked bobwhite's historical range, and none resulted in establishment of a viable wild population.

Searches for suitable release sites within the masked bobwhite's historical range, including Arizona's Altar Valley, began in 1969. Experimental releases made by the Fish and Wildlife Service from 1975 to 1979 led to the reestablishment of a sizeable population on the then privately owned Buenos Aires Ranch. In 1977, natural reproduction of reintroduced masked bobwhites was confirmed at this location. At its peak in 1979, this population included at least 74 calling males. However, two dry summers, coupled with commercial cattle grazing, subsequently caused a drastic population reduction. cursory investigations in 1982 and 1983 confirmed that only a few birds remained. In 1985, additional summer surveys failed to reveal evidence of masked bobwhites on the Buenos Aires Ranch.

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photo by Steven J. Dobrott

masked bobwhite release box at Buenos Aires National Wildlife Refuge at a site that now has excellent habitat

Masked Bobwhite

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In August 1985, the Service purchased the Buenos Aires Ranch for inclusion in the National Wildlife Refuge System. Three months later, a wild adult male masked bobwhite was seen at the refuge headquarters, indicating that some birds had indeed survived.

Biologists at the Buenos Aires Refuge are once again reintroducing the masked bobwhite into its former habitat using a release technique developed by the Arizona Field Station in 1977. The method includes the use of sterilized wild-caught males of a non-endangered subspecies, the Texas bobwhite (*C. v. texanus*), as foster parents for captive-bred masked bobwhite chicks. After a brief adoption

and conditioning period, these family units are released in areas believed to be good habitat for masked bobwhites. From 1985 to 1987, over 4,500 quail were released on the new refuge using this method. Tentative plans call for 5 consecutive years of releases, followed by a 2-year evaluation to determine if release procedures or habitat management practices should be modified and if additional releases are needed.

Breeding by released birds on the refuge has been documented. Although the summer rainfall that stimulates the quail to breed has been scant, one nest, two broods of hatchlings, and a subadult bird hatched in the wild have been observed. Several coveys are being monitored by radio-telemetry. Because little is known about the habitat requirements of the masked bobwhite, studying these birds will help direct future habitat management.

Today, the lush grasslands of the Altar Valley hold a brighter future for this Endangered quail, but the success of the release effort still depends on habitat recovery, weather cycles, and the ability of the released birds to survive and reproduce. The Service's goal is to establish a self-sustaining masked bobwhite population on the refuge within 10 years. If the reintroductions are successful, a unique wildlife component that has been missing from the Southwest for 80 years will be restored to its native habitat in Arizona.

APPROVED RECOVERY PLANS

Carla W. Corin
Division of Endangered Species and Habitat Conservation
Washington, D.C.

Black Lace Cactus Recovery Plan

The recovery plan for the black lace cactus (*Echinocereus reichenbachii* var. *albertii*) was approved on March 18, 1987. The plant was federally listed as Endangered on October 26, 1979, and is also listed by Texas under State law as Endangered. One of the five other varieties of *E. reichenbachii* is proposed for listing as Threatened (*E. r.* var. *chisoensis*; see BULLETIN Vol. XII-No. 8), and another is under review for a possible listing proposal. Six other species in this genus are already listed as Endangered.

The black lace cactus is a particularly attractive plant, usually with a very dark purple central spine 0.08 to 0.11 inches (2 to 3 millimeters) long surrounded by 14 to 16 radial spines, white with dark purple tips, on each areole. Its pink to light purple flowers are 2 to 3 inches (5 to 7.5 centimeters) in diameter. The resulting green fruits have conspicuous long wool on the areoles. This variety grows either as solitary stems or in clumps of 5 to 12. Stems are green, 2.9 to 5.9 inches (7.4 to 15 cm)

tall and 1 to 2 inches (2.5 to 5 cm) in diameter. Some morphological variation is found among the three known populations of black lace cactus, one having plants somewhat larger with well-developed central spines, which are sometimes absent on some plants in the other populations.

Echinocereus reichenbachii, the lace cactus, ranges from western Kansas to northern Mexico. Its large colorful flowers make it popular among cactus fanciers, and it is widely collected. The black lace cactus, *E. r.* var. *albertii*, has been found only in three Texas Gulf Coast counties (Refugio, Jim Wells, and Kleberg), where it grows in sandy-loam brush tracts. Other varieties of the species are usually found among rocks in limestone areas.

The greatest threat to the survival of the black lace cactus is habitat destruction. Many sites formerly home to this plant have been cleared and replanted to pasture or cropland. Grazing presents a danger, as the plants grow in openings among the brushy areas and are thus susceptible to trampling by cattle. Collecting is another threat to this and many other cacti. This plant has been especially

popular because of its large, showy flowers. There has been some collecting of the black lace cactus, but apparently collectors have closely guarded their knowledge of its locations, and there is currently no evidence of collecting pressure.

All three known populations of the black lace cactus are on private land. The Endangered Species Act does not prohibit take on private land, although it does regulate interstate trade in Endangered plants. One of the Jim Wells County populations has been nearly destroyed by clearing. Another group found in that area is quite vigorous and thus far has escaped damage, although some clearing has occurred nearby and the landowner's plans are unknown. In Kleberg County, the earliest known collection was made on a high bank above a creek. This population was later destroyed by brush clearing, as was a second population found later. A surviving population (4 stands) was found in a broad band of brush along both sides of the creek, mostly in small openings among the brush. This also has

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Recovery Plans

(continued from page 7)

been probably saved from clearing by being on sloped drainage areas along a creek bed. In Refugio County, there is a large, patchy population over about 42 acres (17 hectares) adjacent to the Aransas River. During 1986 field surveys, individuals here appeared less robust than at other sites. There were fewer juveniles and some dead plants. Again, this is private land, leased for cattle grazing and petroleum activities.

The objectives of the Black Lace Cactus Recovery Plan include obtaining permanent protection of two or more of the known populations in order to consider reclassification to Threatened status. Full recovery criteria are to be established after the success of management at protected locations can be evaluated and searches for more populations are carried out. An important step has already been taken towards protection of the cactus. Landowners have been identified and are being contacted by The Texas Nature Conservancy. These people are given information about the black lace cactus

and are being encouraged to protect plants on their property. One family has already joined The Nature Conservancy's Land Steward Society, thus indicating a voluntary willingness to protect their black lace cacti. It is hoped that other landowners will follow suit and will consider steps leading to permanent land protection by the Service, The Nature Conservancy, or other conservation agencies.

Research needs to be conducted on various aspects of the black lace cactus' life history. Various attempts to transplant it have not met with long term success. Population dynamics, pollinators, and the restricting soil, climate, and microhabitat requirements must be studied. Searches will be conducted for undiscovered populations, and potential safe habitat for establishment of new populations needs to be found once more specific life requirements are known. Several agencies have land within the range of the black lace cactus where it may be possible to introduce the plant. Also, propagation studies are under way, and if they are successful, a botanical garden population will be established for use in research and public education.

Another important part of the recovery

plan is to curtail any collecting activity that might be discovered. People need to be reminded of trade restrictions pertaining to Endangered species, and any convictions should be publicized as a deterrent. A comprehensive trade management plan for all cacti should be developed to reduce collecting pressure, and thus improve chances of recovery for all Threatened and Endangered cacti.

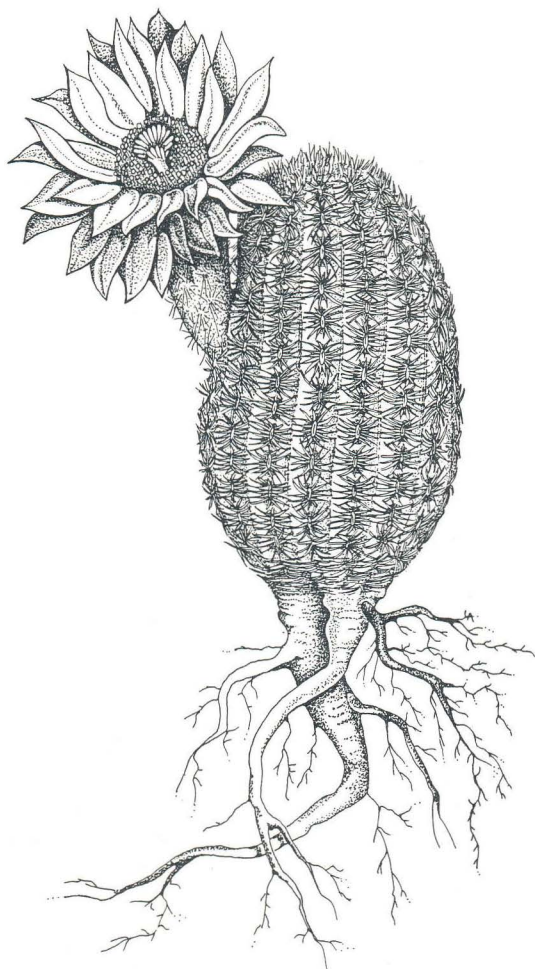
Atlantic Coast Piping Plover Recovery Plan

The piping plover (*Charadrius melodus*) is a small Nearctic shorebird found only in three geographical regions. It nests on sandy beaches along the Atlantic coast from Newfoundland to South Carolina; on sandy beaches in the Great Lakes area (now only at a few sites on the upper lakes); and along major river systems, alkali lakes, and wetlands in the northern Great Plains. On January 10, 1986, the Great Lakes population was designated as Endangered and the other two as Threatened. Two recovery regions have been designated, one for the Atlantic Coast population and the other for the inland areas. The Atlantic Coast Piping Plover Recovery Plan was approved by the Fish and Wildlife Service on March 31, 1988. (The plan for the inland recovery areas was approved May 12, 1988, and will be summarized in a future edition of the BULLETIN.)

The piping plover is about 7 inches (17 centimeters) long, with a 15-inch (38-cm) wingspan. In breeding plumage, it has a light beige back and crown, white rump and underparts, and black upper tail with white edging. The spread wings have a single white stripe, and black wrist marks and trailing edges. The single black breastband and black bar across the forehead are absent from the winter plumage. Breeding birds have orange legs and a bill with a black tip; the legs fade to yellow and the bill becomes mostly black in winter. Although two subspecies (Atlantic, *C. m. melodus*, and Northern Great Plains, *C. m. circumcinctus*) were officially recognized by the American Ornithologists' Union, recent electrophoretic and other studies have not detected any differences across the bird's range.

The Atlantic Coast population nests on coastal beaches, sand spits, barrier islands, and dunes. Piping plovers have also been found nesting on dredge spoil sites of suitable material. The nest is a shallow depression or scrape, often lined with pebbles or bits of shell. Nests are seldom closer than 100 feet (30 meters) apart; the usual interval is over 200 feet (60 m). Incubation of the normally 4 eggs takes 27 to 30 days, and is shared equally by the parents. The well-camou-

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drawing by Linda Ashling

black lace cactus (*Echinocereus reichenbachii* var. *alberti*)



drawing by J. Zickefoose

Piping plovers use a variety of methods to distract intruders from the nest site, including this "broken wing" display.

flaged chicks are precocial, leaving the nest as soon as their down is dry. Families remain together until the chicks fledge in 28 to 35 days. At that time, the birds leave the nesting territories for more communal feeding areas. Reported fledging success rates vary depending on how data are reported, but it appears that productivity in recent years has been below that needed to maintain the current population. Little is known about the winter distribution and ecology of the piping plover. It is believed, based on band recoveries and sightings, that the majority of birds that nest on the Atlantic Coast winter between North Carolina and Key West.

Piping plovers suffered, as did many other shorebirds, from shooting for the millinery trade around the turn of the century. With the passage of the Migratory Bird Treaty Act in 1918 they made a recovery, only to be impacted by habitat loss from dune stabilization and beach-front construction. Some recovery of populations occurred after the major hurricanes of 1938 and 1954, which flattened dunes and destroyed construction, rejuvenating nesting habitat. Since at least 1955 there has been a steady de-

crease. The 1986 breeding census found 550 pairs in the United States from Maine to North Carolina, and 240 pairs in eastern Canada. Over 80 percent of the known breeding is in Massachusetts, New York, New Jersey, and Virginia.

Major factors in the decline of the piping plover include habitat loss, human disturbance, and predation. Studies have found that nesting success is lower on recreational beaches than on undisturbed ones in the same area. Crushing of eggs and young by pedestrian and vehicular traffic and predation by cats and dogs are factors. Biologists suspect that subtle disturbances may cause disruption of territory establishment, leading to nest site abandonment. Disturbance also can result in increased chick mortality due to frequent interruption of their feeding activity. Debris and garbage left by humans may attract predators such as red foxes, dogs, cats, raccoons, opossums, striped skunks, and rats. Predation by opossums has increased as they have spread northward. Avian predators, including the northern raven, black-crowned night heron, fish crow, American crow, and certain gulls, are also a threat. Herring and great black-

backed gulls have both expanded their breeding range southward in recent years, resulting both in increased predation and in displacement of plovers from historical nesting areas.

The primary objective of the recovery plan is to increase the Atlantic Coast population to 1,200 self-sustaining breeding pairs, while maintaining the current distribution for 5 consecutive years. This population could then be considered for delisting. Conservation efforts to date have involved many Federal, State, and local groups. Censusing and research studies have been ongoing for many years. Fencing and posting to divert recreational users, while generally used to protect tern nesting areas, have also been somewhat beneficial for piping plovers. There is a continuing need to direct more of this effort towards the plovers, since their nesting precedes that of terns by 4 to 6 weeks. There has been complete closure of some beach portions on National Wildlife Refuges in Massachusetts, Rhode Island, Connecticut, New Jersey, and Virginia.

The highest priority tasks in the recovery
(continued on page 10)

Virginia Co-op Unit Assists Virginia and North Carolina with Spiny Mussel Recovery

Richard Neves
Leader, Virginia Cooperative Fish and
Wildlife Research Unit

Only three species of freshwater mussels in the world bear processes (spines) on their valves, and each is endemic to a river system in the Southern Atlantic Slope of the eastern United States. Although considerable disagreement exists on the proper binomials and taxonomic relationships among these species, their scientific and common names, according to the American Malacological Union, are the Altamaha spiny mussel (*Elliptio spinosa*), Altamaha River, Georgia; Tar River spiny mussel (*Elliptio steinstansana*), Tar River, North Carolina; and James River spiny mussel (*Pleurobema collina*), James River, Virginia. The Tar River spiny mussel was Federally listed as Endangered in July 1985, and the James River spiny mussel was proposed for

Endangered status in September 1987. The status of both species was reviewed in previous issues of the BULLETIN (Vol. X No. 7 and Vol. XII No. 10, respectively).

Because the biology of all three species is essentially unknown, and the Tar River species is critically endangered, the North Carolina Wildlife Resources Commission initiated a study with funds granted by the Fish and Wildlife Service under Section 6 of the Endangered Species Act to search for remnant populations in the Tar River and to conduct a life history study. Until enough specimens are located to initiate the proposed biological research, the Commission has contracted with the Virginia Cooperative Fish and Wildlife Research Unit to conduct a life history study on the related James River spiny mussel, which still occurs in sufficient enough numbers to be sampled and studied. Objectives of this research project are to describe the reproductive cycle (period of

spawning, gravidity, release of glochidia) and to determine the fish hosts needed by the glochidia to attach and metamorphose to free-living juvenile mussels.

Sampling for *P. collina* began in summer 1987 in the Craig Creek drainage, Craig County, Virginia. Subpopulations were located and will be monitored in 1988 for reproductive traits. The second objective of the study will combine sampling of fishes in streams to identify likely hosts and the collection of gravid female mussels to obtain glochidia for infesting suspected hosts in the laboratory. This work will begin in spring 1988 and continue through summer 1989. If or when sufficient specimens of the Tar River spiny mussel are located, research results on the James River species should expedite the planned life history investigation. Information on the reproductive cycles of these species will be critical elements in any efforts to implement recovery actions.

Recovery Plans

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every plan, those necessary to maintain current population status, are:

1. **Monitor population trends** through annual surveys in each State and province. This will assist in assessing the effectiveness of various management strategies and identify sites requiring more effort or different techniques. Existing survey methods are constantly being refined.

2. **Establish management programs** to improve productivity. These programs will identify landowners on whose property piping plovers nest, and provide them with protection and management recommendations.

3. **Reduce disturbance by pedestrians and off-road vehicles.** This task may involve fencing and posting of nest-

ing areas; using permits, closures, or other restrictions to limit recreational use and access; enforcing pet restrictions; and rerouting off-road vehicle traffic.

4. **Development and employment of predator control techniques**, including investigation of the long-term impacts of predation and other disturbance on the plovers. Some indirect predator control may be accomplished by removing litter and garbage, which attract predators to beaches. More direct methods of predator removal will be studied. Limited trials of predator enclosures placed around plover nests in 1987 produced encouraging results. Testing of this technique will be expanded in 1988.

5. **Gain a better understanding of piping plover wintering ecology.** Additional surveys to determine migration and wintering areas will assist in documenting that part of the plover's life cycle and

determine vital habitat characteristics, particularly on the wintering grounds. This habitat could then be protected.

6. **Develop public information.** The piping plover recovery effort has already benefitted from national news stories and magazine articles that have made more people aware of the bird's plight. Informational brochures, posters, slide/tape presentations, and other tools geared to various categories of beach users also are needed to educate the public and gain more support for the recovery effort.

Other actions needed to provide for full recovery of the Atlantic Coast population of the piping plover include creation of additional habitat by controlling vegetation encroachment, discouraging dune stabilization activities and construction in nesting areas, and encouraging well-timed use of dredge spoil to enhance or create additional nesting habitat.

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southwest of Tucson, Arizona, in late March. In the wild, the species is known from only one locality consisting of eight individuals. The species' native population, located on the Tohono O'odham Indian Reservation, dropped from 25 plants in 1982 to only 8 plants in 1988. The transplanted seedlings were propagated from seed at the Arizona-Sonora Desert Museum and are being carefully monitored. As of May 1, 61 of the 76 transplanted individuals were flourishing in their new habitat. Fifteen of the seedlings died from what appears to have been fertilizer burn. Another lot of 76 seedlings will be transplanted in late

October. The Service hopes to establish a second population of this species to ensure its survival in case the remaining eight wild plants fail.

Peebles Navajo cactus (*Pediocactus peeblesianus* var. *peeblesianus*) is a narrowly endemic plant restricted to specialized soils in central Arizona. Jeanette Milne, Transition Zone Horticultural Institute, and Dr. Barbara Phillips and Dr. Art Phillips, Museum of Northern Arizona, Flagstaff, under contract with the Service, have conducted trace element and mycorrhizal analyses on the soils at two Peebles Navajo cactus sites. (Some seed plants develop symbiotic relationships with soil fungi so that root structures composed of both fungal and seed plant tis-

sues are formed; these are known as mycorrhizae.)

The most striking microelement values were low levels of manganese, iron, and zinc. These low levels might prevent some potential plant competitors from establishing themselves in *Pediocactus* habitat. Low phosphorus levels, also characteristic of the sites, are probably important for the growth of the endomycorrhizae (in which fungal tissue actually grows within the roots of the higher plant) that characterize the roots of *P. peeblesianus*. It is typical to find mycorrhizae in very rocky, droughty soil conditions in which non-mycorrhizal plants have difficulty surviving. Mycorrhizae could provide a competitive edge for the cactus in these soils

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Regional News

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by greatly facilitating the absorption of the available water and nutrients by the cactus. Other plants might more easily compete with the cacti in other areas because of more favorable moisture conditions.

The Kemp's ridley sea turtle (*Lepidochelys kempii*) nesting season started late at Rancho Nuevo, Mexico, again this year, probably due to cool spring temperatures. The first turtle did not nest until April 21 and an additional 24 turtles nested the next day. Richard Byles, project officer for the ridley project, placed satellite transmitters on the first two turtles encountered and he has been collecting data on dive durations, surface durations, water temperatures, and locations from the turtles since the transmitters were deployed. Plans call for an additional 16 transmitters to be attached to adult ridleys by June of this year as part of a year-long movement and behavior study. An additional study was initiated this year with Kemp's ridleys in order to address tag loss with the Monel flipper tags currently in use. A new tag, the Passive Integrated Transponder (PIT) tag, is being implanted in the muscle of the left foreflipper of each turtle also tagged with a Monel tag. The PIT tags are the size of a grain of rice and are imbedded in a glass capsule. When interrogated by a hand-held reader, they emit a unique 10-digit ID code. The expected life of a PIT tag is 25 years or more.

Region 4 - A cooperative project to mark cavity trees of the Endangered red-cockaded woodpecker (*Picoides borealis*) on private lands continues to benefit the species. Initiated last year, the project is being conducted in the towns of Pinehurst and Southern Pines, North Carolina. These communities contain the largest known red-cockaded woodpecker population on private lands, estimated at about 130 birds. Approximately 600 cavity trees have been marked with 5x5-inch aluminum signs portraying the species and stating that the trees should not be cut. Each sign includes instructions to contact the North Carolina Wildlife Resources Commission or the local building inspector for information. Town planners in Pinehurst and Southern Pines have conditioned permits to prevent the destruction of marked trees. Contacts with landowners have provided a significant public relations benefit. Only one landowner did not want the trees on his property marked, and he was already aware of the trees and did not indicate any adverse feeling toward the species. As a result of this project's success, the Service hopes to secure funding to prepare generic signs that could be used on cavity trees through the Southeast. Cooperators in the North

Carolina project include the Service's Asheville, North Carolina, Field Office, the North Carolina Wildlife Resources Commission, North Carolina State University, and the town planners of Pinehurst and Southern Pines.

The Asheville Field Office and the U.S. Forest Service are continuing to monitor the Bachman's warbler (*Vermivora bachmanii*) population in Francis Marion National Forest, South Carolina. This area is one of the last documented nesting sites for the species, which has a 150-year history of disappearing from its known habitat for years at a time. The monitoring, which was agreed upon by the two agencies as part of an earlier formal consultation on the species, involves the experimental cutting and regeneration of a variety of different stands within the swamp forest. It is hoped that these habitat alterations will provide suitable nesting conditions for this bird, which was last sighted in 1980 in Cuba. The bird is now considered by many to be the rarest warbler in North America.

An overlook and trail facility on the Blue Ridge Parkway in North Carolina has been designed to avoid a recently located population of Heller's blazing star (*Liatris helleri*). Park resource management staff and landscape architects cooperated with the Fish and Wildlife Service and the National Park Service to complete the project. Also, permanent monitoring plots were established to measure the effects of trampling and increased visitor use on this species. New trails and visitor facilities have just been constructed as a result of the completion of the last section of the Parkway near Grandfather Mountain.

Region 6 - Both the Service and the Wyoming Department of Fish and Game are looking optimistically toward a strong comeback by the black-footed ferret (*Mustela nigripes*). Last year, the captive breeding program at Sybille, Wyoming, produced seven kits. The births brought to 25 the number of ferrets in captivity, but one died of cancer in January. Most of the 15 females have bred this spring, and up to 50 kits may be born in captivity in late May or early June. Dr. Tom Thorne, Wyoming Game and Fish Department, cannot provide guarantees, but there is great hope based on experience gained from last year's success.

Plans are under way to establish a second captive breeding population this summer. Wyoming and the Service advertised for different zoos to express an interest in providing facilities to house the second ferret population. It has been decided that establishing a second captive population would avoid having "all of our eggs in one basket" and would safeguard the species from extinction due to disease, fire, or some other unexpected catastrophe. Several proposals have been received in response to the advertisement, and a

decision on the site of the second captive breeding facility should be made soon.

With optimism for success of the captive breeding effort, the Service, in cooperation with other State and Federal agencies, is beginning to identify major prairie dog complexes that may be suitable for reintroduction sites. Through the Interstate Working Group, which currently represents 9 of the 14 States in the ferret's historic range, groups are mapping prairie dog complexes. Once they are mapped, they will be prioritized from a biological standpoint as to their suitability for ferrets. With good captive reproduction, establishment of a wild population could be attempted as early as 1991. Other reintroductions would follow in succeeding years. The Recovery Plan identifies the need for 10 widely distributed populations.

The final recovery plan for the North Park phacelia (*Phacelia formosula*) has been printed and distributed. There are nine known locations of this plant, which is only found in Jackson County, Colorado. Threats to its survival include off-road vehicle activity; livestock grazing, trampling, and trailing; and coal, oil, and gas development. The plan calls for protection of existing populations and research on the species' habitat and biology. Recovery plans can be purchased from the Fish and Wildlife Reference Service, 6011 Executive Boulevard, Rockville, Maryland 20852 (telephone toll-free at 800/582-3421).

A study of the Uncompahgre fritillary butterfly (*Boloria acrocneuma*) was conducted in 1987, but a second year of studies must be conducted before the status of the species can be determined. The study will be jointly funded by the Fish and Wildlife Service, Forest Service, and Bureau of Land Management. After the results of the second year of study are known, these agencies will work together to develop conservation measures for the species. It is currently known to inhabit a small number of alpine meadows in Colorado.

Region 8 - The Florida Cooperative Fish and Wildlife Research Unit and the National Ecology Research Center are involved in an interagency study of the ecology of West Indian manatees (*Trichechus manatus*) in the Cumberland Sound region of Georgia. One purpose of this study is to determine the potential effects on manatees of dredging in the Sound. This information is needed to mitigate human-caused manatee deaths throughout the manatee's summer range. Through radio telemetry, manatees are studied during the spring and summer when they are present in the Cumberland Sound region. Time spent in the region by tagged manatees, areas of greatest use,

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Regional News

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and manatee behavior (particularly feeding behavior) are being noted.

In 1987, four radio-tagged manatees were studied in Cumberland Sound. Two had been tagged in March at Fernandina Beach in Nassau County, Florida, and two that were radio-tagged in Brevard County, Florida, migrated to Cumberland Sound in May. Tagged manatees were present in the region throughout the spring and summer at various times. Several areas were repeatedly used by tagged as well as untagged manatees. They were observed to feed at high tide on *Spartina* growing at the water's edge. As part of the study, another manatee was radio-tagged February 25 at Fernandina Beach.

Biologists from the Patuxent Wildlife Research Center's Hawaii Research Station assisted State personnel in a comprehensive nonbreeding-season population survey of the Endangered palila (*Loxioides bailleui*) on February 2-4, 1988. The evaluation was conducted on the wooded slopes of Mauna Kea, the last remaining habitat of this bird. A total of 219 palila were recorded at 65 of 150 stations censused on 10 transects. The population was estimated to be 4,350 birds (with a 95 percent confidence range of 3,199 to 5,517 birds). This latest estimate reflects a 26 percent increase over the July 1987 count. The increasing trend since 1985 is encouraging; however, the palila is still restricted to only a small portion of the apparently suitable habitat on Mauna Kea.

In February, Hawaii Research Station staff biologists completed an aviary study to quantify potential behavioral effects of radio telemetry transmitters on the palila. Results indicated that the behavior of palilas with "placebo" transmitters was not

Category	ENDANGERED			THREATENED			SPECIES* TOTAL	SPECIES WITH PLANS
	U.S. Only	U.S. & Foreign	Foreign Only	U.S. Only	U.S. & Foreign	Foreign Only		
Mammals	28	19	240	3	3	23	316	25
Birds	61	15	145	7	3	0	231	59
Reptiles	8	7	59	14	4	14	106	22
Amphibians	5	0	8	4	0	0	17	5
Fishes	41	2	11	25	6	0	85	45
Snails	3	0	1	5	0	0	9	7
Clams	29	0	2	0	0	0	31	22
Crustaceans	5	0	0	1	0	0	6	21
Insects	8	0	0	7	0	0	15	12
Plants	140	6	1	33	3	2	185	70
TOTAL	328	49	467	99	19	39	1001	269 **
Total U.S. Endangered 377 Recovery Plans approved: 229								
Total U.S. Threatened 118 Species currently proposed for listing: 22 animals								
Total U.S. Listed 495 26 plants								
*Separate populations of a species that are listed both as Endangered and Threatened are tallied twice. Those species are: the leopard, gray wolf, grizzly bear, bald eagle, piping plover, roseate tern, Nile crocodile, green sea turtle, and olive Ridley sea turtle. For the purposes of the Endangered Species Act, the term "species" can mean a species, subspecies, or distinct vertebrate population. Several entries also represent entire genera or even families.								
**More than one species are covered by some recovery plans, and a few species have separate plans covering different parts of their ranges.								
Number of Cooperative Agreements signed with States and Territories: 51 fish & wildlife								
April 30, 1988 36 plants								

different from that of control birds without transmitters. Following the aviary study, a full-scale radio telemetry study on free-ranging palilas began on February 22 to determine palila habitat selection and use, daily movement patterns, and home

range. Ten adult palilas (five males, three females, two of unknown sex) have since been mist-netted, weighed, measured, banded, and fitted with operational radio transmitters weighing approximately 1.3 grams.

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ENDANGERED SPECIES

Technical Bulletin

Department of the Interior, U.S. Fish and Wildlife Service, Washington, D.C. 20240

ecosystems and efforts to ensure that several systems of each type in each geographical locale receive protection.

Organizations like the Nature Conservancy and other private ecosystem protection groups have already done much to identify areas where more protection is necessary and have efforts under way to provide it. Federal and state governments should cooperate by offering financial assistance, by helping to coordinate ongoing efforts, and above all, by limiting the use of publicly owned lands that are appropriate for habitat protection. Private owners of lands requiring protection could be compensated with other less sensitive and perhaps more economically productive public lands in a program of land trading.

What is needed is an over-arching authority that has responsibility for matters of biological diversity more generally. It should have both domestic and international responsibilities and its main function will be to gather information and to devise means to protect habitat. This authority should cooperate fully with state agencies and private land-protection groups worldwide. It is essential that the U.S. government reassert its world leadership in the effort to conserve biological diversity.

It is known that an extinction event of epic proportions is coming, indeed, that it is underway. It is not known how to stop it, but it can be slowed by saving as much habitat as possible in as large preserves as possible. This requires holistic thinking—success will depend on saving intact ecosystems. Attempts to evaluate species individually lead to judgments that some species for which we know no use are not worth the cost of protection. If enough such decisions are made in any given ecosystems, it will be destroyed by increments and other, valuable species that depend on the ones that were sacrificed will eventually die out as well.

The folly of evaluating individual species economically and deciding that some are not worth saving defies scientific understanding of ecosystems—The large, spectacular species that are designated for protection exist at the top of the biotic pyramid, dependent on the

ones below them. Humans, as the spectacular and large species that is presumably at the top of the list for preservation, also rests upon the less spectacular species that creates biomass and oxygen, and regulate the climate.

And thus a variety of practical and prudential arguments point away from the species-by-species approach to conservation. Similarly, these same arguments militate against formulating the priorities question mainly as one of rating individual species as having high or low priority for protection. Priority should be placed on saving habitats—this approach provides maximal protection for as many species as possible.

Once conservation efforts are shifted from a species-by-species approach to a more holistic one, there will still be an important place for efforts to protect remnant species and populations: many species are already too threatened to survive merely through habitat protection and, despite our best efforts to protect their habitats, others are likely to become threatened in the future. When there are recognized reasons for treating a particular species as having special economic, cultural, aesthetic, or ecological value, there are special reasons to protect it, which may justify protection and recovery programs.

But it is a mistake to think of an office devoted to listing and protecting already endangered species as the core of a national program of species preservation. The emphasis of the Office of Endangered Species should therefore shift considerably, with less effort expended in listing species and no assumption made that every endangered species be given special protection. Indeed, the listing process might be phased out. This may imply abandoning some species now identified as endangered and allowing events to take their course. But more species will be saved by efforts directed at habitat protection than by efforts to identify, list, and develop recovery programs for each individual endangered species. Scaling down the listing process would, presumably, free resources for a coordinated campaign to protect habitats.

Since the bulk of threatened spe-

cies are found in other parts of the world, especially in the tropics, a complete endangered species protection policy must address the problem globally. Obviously, the U.S. government cannot act unilaterally within the boundaries of another nation. But supported by funds and efforts by the United States, programs of international cooperation could make a tremendous difference in setting aside preserves of undisturbed habitat throughout the world.

It may be protested that the task set is too large, that it would cost too much in lost developmental opportunities. But I believe that, compared to the benefits (considered in the broadest terms over the longest run), a comprehensive policy to protect biological diversity may represent a remarkable bargain for the human species.

Bryan G. Norton is professor of philosophy at Georgia Institute of Technology. This article was adapted with editorial assistance from Claudia Mills, from his book, *Why Preserve Natural Variety?* Princeton University Press, 1987. An earlier version was published in *QQ*, the quarterly of the Institute of Philosophy and Public Policy, University of Maryland.

Catching Up on The Update's Publication Schedule

As you may notice, this month's issue of the Update contains two reprinted issues of the Endangered Species Technical Bulletin. Due to the recent reorganization of the Office of Endangered Species, the ESTB'S publication schedule has been somewhat irregular. As soon as we receive materials from the FWS, we reprint them and send them along to you. This month, we received two reprints. In the interest of getting the bulletin to you sooner rather than later, we have combined the June and July issues. We hope to return to our regular schedule this Fall. Until then, we appreciate your patience.

Book Review

Land-Saving Action

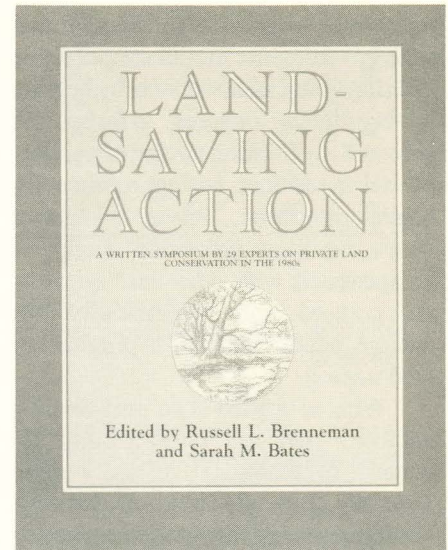
edited by Russel L. Brenneman & Sarah M. Bates

As land trusts gain increasing prominence in the United States, they have come to play an important role in species preservation efforts. Whereas the creation of refuges, parks, and wilderness areas has traditionally been associated with the public sector, privately funded land trusts have grown increasingly sophisticated in supplementing government programs and developing alternative, innovative acquisition and management strategies for species and habitat protection.

Land-Saving Action, a collection of 35 articles, is one of the most recent books on the subject. Although the role of land trusts in endangered species conservation is not specifically discussed (this is one of the book's weaknesses), the book serves as a practical reference that conveys both the spirit

and the techniques of land trust activity.

The book is a product of the first gathering of land trust activists in 1981. There are articles on specific trusts as well as essays discussing such issues as how and when to form a land trust, how and why to acquire federal and state tax-exempt status, the options for acquiring and managing land, and the appraisal of rights in land. Various authors explore the use of land trusts to manage and protect farmlands, forestlands, scenic areas, and urban lands. Shorter pieces by prominent land trust leaders are intermixed with articles by land trust attorneys on land rights, the acquisition process, and taxation. As such, *Land-Saving Action* provides much of the background information for those interested in habitat and species conservation through private initiatives.



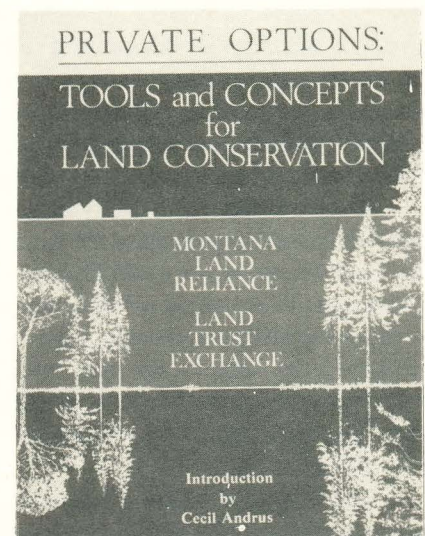
Land-Saving Action is published by Island Press, Star Route 1, Box 38, Covelo CA 95428. hardcover \$64.95, softcover \$34.95.

Private Options: Tools and Concepts for Land Conservation Montana Land Reliance and the Land Trust Exchange

Private Options: Tools and Concepts for Land Conservation is a collection of over fifty short articles co-edited by the Montana Land Reliance and the Land Trust Exchange. Like *Land-Saving Action*, *Private Options* explores the land-trust movement's traditions, motives, and objectives, and points out problems land trusts face. Yet it is primarily designed as a practical handbook for practitioners in the field. In the preface, the editors introduce the book as a smorgasbord of tools and techniques that have been developed by over 500 land trusts across the country.

The opening essay by former Interior Secretary Cecil Andrus outlines the tremendous potential for private sector

involvement in land preservation, and the role of such efforts in the environmental movement as a whole. The remainder of the book is organized in nine sections including: skills in marketing, negotiation, and land evaluation; economic strategies and tactics for purchasing easements and taking advantage of tax incentives; public/private relationships in land conservation; organizational design strategies, and resources available to land trust organizations. Although some of the papers are rather narrow in scope and address only specific technical issues, the collection as a whole provides an interesting look at the development and future directions of the land trust movement.



Private Options: Tools and Concepts for Land Conservation is published by Island Press: Star Route 1, Box 38, Covelo, CA 95428. softcover \$25.00.

Drought, Deluge, and Endangered Species

by Dennis D. Murphy & Stuart B. Weiss

As if society needed a reminder of its dependence on the vicissitudes of climate, 1988 has become the year of the drought — delivering crop failures, water rationing, and soaring utility bills. While the present drought is most noteworthy for its grand geographic extent, it can hardly be considered an anomaly. Indeed, since similar conditions occurred over several year periods in the 1880's and again in the 1930's, it is tempting to hypothesize a 50-year "cycle" of drought events. Regardless of our hypotheses and predictions, however, the ecological and conservation significance of droughts, deluges, and other climatic extremes lies in their unpredictability. Clearly, climate has played major roles in shaping the distributions and abundances of many of our threatened and endangered species. We must consider this role, and its stochastic nature, to best protect species and areas of conservation concern.

Paul Ehrlich and his colleagues at Stanford monitored populations of checkerspot butterflies (genus *Euphydryas*) across the western United States for more than a decade preceding the 1975-77 California drought. The diversity of responses to the drought recorded for geographically and ecologically widely-separated populations underscored the danger of generalizing about the effects of environmental phenomena based on observations of just a few populations - even within a taxonomic species. Populations of the threatened bay checkerspot butterfly (*Euphydryas editha bayensis*) in central California grasslands declined precipitously or went extinct when their annual larval hostplants senesced extremely early. At the same time, populations of an alpine subspecies (*E. editha nubigena*) actually increased when the light snowpack melted early. In drought years, while low elevation

growing seasons shorten, growing seasons at high elevations tend to advance, and even lengthen.

Climatic extremes can be especially devastating to species with narrow distributions and highly restricted resource requirements. Even mild climatic fluctuations can mean local extinction for small populations within remnant habitats. Many species survive environmental extremes in but a fraction of their natural geographic distribution; once habitats are lost, "shifting mosaics" of populations can be disrupted, and what historically would have been temporarily vacant patches become permanently lost habitat. Endangered aquatic species with fragmented, localized distributions may be severely affected by drought, especially in regulated river systems where the conflicts between power generation, irrigation, domestic use, and wildlife seldom are resolved in favor of wildlife.

Drought can also set the stage for catastrophic epiphenomena that can threaten vast numbers of species across wide areas. For example, severe drought during the El Nino/Southern Oscillation event (ENSO) of 1982-83 led to extensive forest fires which raged for months in the normally moist Indonesian rainforests of Kalimantan. Fires of this nature may recur on a time scale of centuries, yet must be considered in conservation planning.

While the 1982-83 ENSO global climatic sequence desiccated the western Pacific, it brought deluge to the eastern Pacific. California received two to three times its normal precipitation, affecting a wide variety of species. Snowmelt at high elevations came late or not at all, and some of the same alpine checkerspot butterfly populations that thrived during the drought went extinct. Bay checkerspot butterfly populations which usually had increased in size fol-

lowing wet years, underwent severe declines due to the lack of winter sunshine. The ENSO also furthered the already precipitous decline of the Sacramento River winter-run of the chinook salmon, now a candidate for endangered species listing. Yet, high spring and summer flows allow smolts of other seasonal salmon runs to escape irrigation diversions, leading to central California's recent successful ocean salmon season in 1987.

Dealing with climatic extremes well may be the biggest challenge facing conservation biologists. Even consideration of normal month to month variability poses problems: how many restoration projects have failed in the short-term because "it didn't rain when it was supposed to?" Conservation plans to ensure the persistence of endangered species must include guidelines for protection against "50 year" droughts or "100 year" floods. Ideally, of course, we should be concerned with "500 and 1000 year" droughts and floods. Regional weather history should be examined for variability and climate extremes. Extrapolation from the most extreme year in a monitoring period to a "worst case" scenario is risky and should be tempered with an understanding of long-term and infrequent climatic events. As populations of butterflies wink out with the drying of their hostplants, and as wildfires consume over one million acres of Alaska wilderness in 1988, we are reminded, yet again, that our best conservation efforts will always be challenged by an uncertain climate.

Contributions to the Technical Notes section are welcome. Articles should be three double-spaced typed pages in length and focus on issues in species conservation research. Materials should be sent to: Kathy Freas, Center for Conservation Biology, Stanford University, Stanford, CA 94306 (415) 723-5924.

Bulletin Board

New Publication on Tropical Rain Forests

Tropical Rainforest: Diversity and Conservation, a new book edited by Frank Almeda and Catherine M. Pringle, is now available from the California Academy of Sciences. The volume contains the entire proceedings of a two-day symposium held at the California Academy of Sciences in September 1985. The papers reflect an international geographic emphasis on the New World tropics. Papers address tropical forest diversity, the potential value of tropical species, effects of ecological isolation, applied aspects of tropical biology, and the important information to be learned from ethnobotanical studies. The book costs \$30.00, plus \$2.25 per order for postage and handling. To order write: Publications Office, California Academy of Sciences, Golden Gate Park, San Francisco, CA 94118.

International Sea Otter Symposium

The first International Sea Otter Symposium, cosponsored by the government of India and the IUCN Otter Specialist Group, will be held in Bangalore, India, from October 16-19, 1988. The

purpose of the meeting is to increase the knowledge and conservation of the otter species and their habitats throughout Asia. The program will include formal summary papers on otter research and conservation throughout the world, sessions on captive breeding, workshops on Asian otter identification and survey techniques, and reports of the status of otters throughout India and Asia. Papers are invited on all aspects of Asian otter biology and conservation. Wildlife and zoo biologists and conservation and government representatives are invited. For more information, contact Conference Chairman, Pat Foster-Turley, Marine World Foundation, Marine World Parkway, Vallejo, CA 94589, USA.

35th Annual Systematics Symposium

The 35th annual Systematics Symposium is scheduled for October 7-8, 1988 at the Missouri Botanical Garden. The organizing theme of the Symposium is Conserving Biological Diversity - Prospects for the Twenty First Century. Speakers include David R. Given (CSIR, New Zealand), Donald A. Falk (Center for Plant Conservation), Alan

R. Templeton (Washington University, Missouri), Stanley Temple (University of Wisconsin, Madison), and Michael Soule (University of Michigan). The registration fee is \$35.00 or \$30.00 for students. For more information write to: Systematics Symposium, Missouri Botanical Garden, P.O. Box 299, St. Louis, MO 63116-0299, Phone (314)577-5167.

Brochure on Biosphere Reserves

U.S. Man and the Biosphere Program is offering a full-color brochure on biosphere reserves. The brochure contains a map of the international network of biosphere reserves in relation to the world's biomes on one side, and a description of the characteristics, functions, and uses of biosphere reserves, the selection process, and history of the biosphere reserve program on the other side. The Secretariat has a limited number of brochures available for free distribution. To order, contact: Phyl Rubin, OES/ENR/MAB, Department of State, Washington, D.C. 20520; (202)632-2784.

Bulletin Board information provided by Jane Villa-Lobos, Smithsonian Institution and the Journal of the Society for Conservation Biology

Endangered Species UPDATE

School of Natural Resources
The University of Michigan
Ann Arbor, MI 48109-1115

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